QRPp

Journal of the Northern California QRP Club

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From the Editor
by Doug Hendricks, KI6DS
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Summer is fast drawing to a close as I write this at the end of July. There has been a lot going on, and it is exciting news. The Cascade sales were phenominal. We kitted 200 of the kits, and have most of them spoken for. Hopefully all will have been shipped by the time that you read this.

In the March issue, I printed an article on the Neomyte, which was a cigarette sized 75M SSB transceiver by VE7TX. Joe has updated the article, and we should have it ready for the December issue. Also, coming in the December issue will be an article on the Cascade, by John Liebenrood. And we will have a full report on the results on the QRP to the Field Spring Contest that was sponsored by NorCal and run by Bob Farnsworth. There was just not room in this issue for everything that we wanted to print.

This issue does feature some great articles and I would like to draw your attention to the announcement on the availability of NorCal Membership Certificates on page 63. Bob Finch contacted me last winter and wanted to know why NorCal didn't have membership certificates. I explained to him that no one had thought of it, and that no one had done it. He offered to take care of the matter, and now we can take advantage of the fruits of his labors. He has done an outstanding job in true NorCal fashion. Please remember to make out checks and money orders to Bob and not to NorCal when you place your order. Thank you Bob for stepping forward and taking care of this.

I have more exciting news. Plan on attending the Pacific Division ARRL Convention at the Concord Hilton Hotel in Concord, California Oct. 20-22. It will be an exciting weekend full of QRP activities. We have firm plans for 2 QRP sessions, in the large lecture room. John Liebenrood, K7RO the designer of the Cascade and Derry Spittle, VE7QK who designed the Epiphyte, will speak on Saturday on SSB and QRP. Wayne Burdick, N6KR, will talk about his latest CW designs and then Stan Goldstein, N6ULU will tell you how to work over 100 countries with a NorCal 40 at the Sunday QRP session. NorCal will sponsor a hospitality room at the NorCal - ARCI booth on both Friday and Saturday nights. Several of the National Officers for ARCI are planning on attending, so it will be a chance for you to meet them. They are helping with the booth costs for the second year, and we thank them for their help.

CORRECTION: Floyd Carter, K6BSU, sent me the following corrections for the "73 Special" that was printed in June QRPp. **Receiver:** 1. A 100K resistor should be added between +5V and IC3, pin 3. C8 also goes to IC3, pin 3. 2. On IC2 the +12V should be on pin 8. Ground is pin 4. 3. On IC3 ground should be pin 11. **Vackar VFO:** 1. The lower end of C1 should be grounded, not to C2, C3 etc. 2. R12 is a 10T Helipot with turns counter dial. 3. C4 should be a 13pF N330 ceramic disc (temp compensation). 4. Subs for the SK3050 are NTE221, NTE454 or RCA40673. **Building Tips:** 1. K1 in the transmitter can be replaced with a st of contacts on the T\R switch, use a DPDT. 2. Use a bolt on heatsink for Q3. 3. An NTE612 will sub for the MV2104 varicap. 4. In the receiver a TL084 will sub for the LM324. Floyd also has photos showing the enclosure, and circuit boards which will help in the construction. If you are building the rig please don't hesitate to contact Floyd, but please send $1 if you want copies of the photos, and if you are writing for help, include a SASE, #10 business sized. Floyd's address is: Floyd Carter, 2029 Chist Dr., Los Altos, CA 94024.

One last note. I am running for election as the Western Representative on the ARCI Board of Directors. I would appreciate your vote. Thanks, 72, Doug, KI6DS

AA7QY Field Day Report

By Roger Hightower, AA7QY
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Well, it's over. Interesting exercise...my first as a QRP station on natural power. Lots of activity, as I'm sure you all know, but not too many folks had ears for qrp stations. Most of my contacts were with the West Coast, Texas and Colorado. I did pick up Utah, Idaho and South Dakota, which are rare in any case.

31 qso's only, but had limited operating time and was stuck on 40M the whole time. The only qrper I heard was NA5N answering someone else's CQ, and didn't have a chance to call him since the frequency was in use.

I ran the QRP+ to a random wire with a 7.5 amp gel-cell charged by a solar panel, and did have a lot of fun. CW only, since I haven't received the back-ordered mike and haven't gotten around to making one that works.

The real excitement of the weekend was a Saturday night visit by a black bear some 30 yards from my station, tearing up a stump looking for grubs. Abby, my Springer Spaniel did a lot of woofing and growling, but fortunately did not get the bear's attention. It did put an end to the night-time operations, though. Discretion, valor and that sort of thing. Fear, really!!

Hope all of you had a great time. Sorry I missed you, and will work harder next time. Maybe the QRP Afield thing this fall.

72/73, de Roger, AA7QY

NW QRP Club Field Day Report

By Brian K High, KV9X
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Whew ... what a weekend! The NW QRP Club's Field Day effort was a lot of fun. We had visits from two local papers (SW Wash. area). We made the 2nd page of one of them on Sunday with a picture of Bill, N7MFB working RS-12 with two QRP +s. The uplink used a tuned 20M loop (reduced size, mast mounted at about 15-20'). The downlink used a 15M/10mMyagi at about 25'. Unfortunately, the caption in the photo said we were just tuning in a broadcast. Oh well. We expect to have something in a weekly paper as well. We also used an 80M Bic (TM) dipole at 50' fed with 300 Ohm tv twin lead, a sloping 40M loop, two 20M phased verticals, a 10/15/20M 3 element yagi, and a 5 element yagi for 2M at about 30'.

We had a lot of trouble with interference between the two transmitters, especially when one was on 20, 15, or 10M. While we moved the 15/10M yagi, the press was shooting away at the spectacle (we moved it without lowering it). This didn't really help, particularly since the real problem was that the SWR was off. Once it was properly tuned things worked out okay ... at least for Saturday. Hi!!

The Bic (TM) worked well on 40, but the loop (sloping to about 8') did better. We did use the Bic (TM) all night on 80M and 75M SSB. I made it the night before we left ... what a light-weight antenna! I will use it backpacking this summer (to Alberta I think). I may want to build one of Roy's (W6EMT) "Z-Match" tuners. His was really nice. (He had a great CMOS Memory Keyer also ... Thanks Roy!)

Unfortunately Marcia's call-sign didn't come in time, so we didn't run a Novice sta-

tion. She had a lot of fun, though, and learned a lot. She has the feeling she will really enjoy contesting when she gets her code speed up.

I hope y'all had a ball as well. I bet you did!

72, Brian, KV9X

FD '95 Report from La Estancia de los Guajalotes Sonrientes

By Nils Young, WB8IJN
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Ok, so I get home from work on Friday, having field tested the Argosy set up on the parking lot light poles. So I unpack everything and put it back in the shack and go out to eat and take my medication and try to keep from going out into the shack but I can't. So I futz around out there for a while and then come in. Cindy catches me at the fridge: "Mom called. Tomorrow is the Fire House Pancake Breakfast. We're going to go over around 9 and eat and then watch the parade. And you have a haircut appointment at 12:30."

I wish I had more whiskey. I drink some seltzer with a twist of lime and go back out to the radio shack. I solder some wires together and burn myself and then come inside and prepare to crash.

I get up the next morning around 8. Andy (the youngest) is downstairs watching some sort of mind-numbing anti-intellectual pap on "Nicktoons." I go out to the shack and look at some stuff. I can feel one of those killer headaches coming on. I go into the house and eat two ibuprophens and two acetaminephens and drink a big glass of water. Cindy shows up. We begin the Saturday morning rushing around and getting ready to do something that we call relaxing. We find my keys. We go to grandma's and the firehouse and eat and watch the parade. The headache has begun to tip the scales toward minor convulsions in a dark room waiting for a quiet death. I go back home, eat some more pain killers, drink a half an espresso and go back to get my hair cut.

"I hope this haircut can kill this headache," I say, walking in the door. The scissor-wielding blond (I'm not so far gone I can't recognize good-looking women) says "Sit down, honey. I'll be right with you."

I sit. She cuts my hair. It's a Hemingway bit. Simple sentences. A conversation. She finishes my hair. I look in the mirror. I look good. I am ready for a job interview. I look normal. My headache is gone. I pay and give her a substantial tip.

When I get home, all the pain killers have finally taken control of my brain. I go upstairs, put on my cut-off jeans and pass out. Five hours later, around 6 p.m., CIndy comes up to get me. We have a dinner reservation at one of the fancy places downtown. One of the few places downtown still open, now that everyone else has fled to white suburbia and the security of little housing developments where you can't put up an antenna. Been there. Done that.

We go to eat. The food is good. I get to thinking about Vygotskian stuff and write a whole course outline on a dinner napkin. A paper one. The table, in fact, is covered with a square of white paper. I write more stuff on it. Cindy and I talk. Caves, buildings, how the food tastes. Postmodernism. The usual.

We go home. I go out to the radio shack. Everyone is having a good time. I have decided that I will not start out 1D and then suddenly become 1B or something. I check the equipment. It works. I am happy. I go in the house, take a shower and hit the sack.

Sunday morning dawns. I get up and find Andy watching some more mindless pap. Out in the radio shack, I open up the Argosy and change the timingon the AGC. Then... ah,

then.. then I notice why the frequency has been so jumpy. I park the radio and listen. The freq shifts. The back thrust bearing on the PTO is cracked. Straight through. And now... now comes the interesting part.

I set to removing the PTO. In the course of leaning over the bench to fix the radio, I somehow screw up my back. I have to very carefully pull myself erect, lower myself into a chair and then try to figure which way to lean so that I don't get the "knife in the back" pain to which I have become not at all accustomed over the past 10 years or so. And I still have to fix the PTO.

To make an already long story short, by the time I fixed the PTO (and it's weird why Ten Tec never made the shaft on the PTO run to ground...thus leaving the user with a strange "hand capacity effect" or whatever they used to call it), it's 1 hour left of FD. I listen around. Everyone is very slow and very quiet and I think that they must be all just about burned out. I go back into the house, take four each of every pain killer that I've got and go upstairs to lay down. Cindy has stripped the sheets off the bed. The PTO is fixed and I could give a hoot less about civility. I roll, groaning in pain, onto the bed and fall asleep. Three hours later, the pain is still there and now... now it's time to go to the grocery.

So my FD experience this year — one that would, I thought, mark an end to nearly 10 years of radio silence in this house — came out to this:

1 contact. On 40m. The Friday before FD. 5 watts into a light pole in the university parking lot. Great fun, this.

So, how'd it go for youze people? Chigger bites? Lyme disease? Cold beer? Warm beer? Wasps come zooming in? Fall asleep over the key, sending out a continuous stream of "dits"? Run out of gasoline? Oh, weather. How was the weather? I think we need a complete rundown on the weather. Yep.... so....

The weather here was sunny on Friday, very hot and humid with a few thunder showers now and then. The lightning did not hit the light pole. I was careful. On Saturday it was on and off again and it didn't make much difference anyway. Hot and humid. Sunday, I don't know. I slept through some of it. And the rest of the time I was too busy cussing and groaning.

Oh, did I mention that I also had to take Andy over to the crazy toy store to get him a "big, rubbery fish"? Well, I did that too. It was cool. They have rubber chickens and rubber fish and rubber faces. There's one that has a bunch of fingers where the mouth should be. One of Ian's friends wore one on the way to the house on Halloween. Scared the crap out of Andy. He had a little problem with that "momentary suspension of disbelief" thing. Wayne came in the house. Andy took one look at Wayne. Wayne made the fingers wiggle. Andy ran and hit behind his mother. SO much for the big rubbery Wayne. That's why we had to get the big rubbery fish. Appease the rubbery gods, I think it was.
73 Nils WB8IJN

Athens County Ohio ARA Field Day

By Eric McFadden, WD8RIF
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Greetings, fellow QRPers! Field Day 1995 is over. The Athens County (Ohio) Amateur Radio Association (ACARA) competed in category 1A from the County Fairgrounds. Our Field Day team consisted of six members, about half being CW ops, the other being Phone men. We operated under the callsign W8MHV. This was the first Field Day the

ACARA has participated in as a club in several years.

We installed an 80/40m fan dipole between a large tree and a flag pole and a 15/20m fan dipole between two trees. We operated from an open picnic shelter, but had a tent in case the bugs got too bad—they didn't—and a mobile home in case the thunderstorms got too bad—they didn't. It didn't rain during set up, but did rain nearly all night.

Our rig was the club president's Argonaut 515, and we tried his newly-purchased MFJ 20m CW rig for a short while. The only significant problem we had was QRM; the Argonaut lacks an IF CW filter, and the Radio Shack DSP unit we tried wasn't ideal for the very crowded bands. (Our back-up rig was my HW-8, a fine rig for occasional use, but it would have been dreadful for Field Day! I'm glad we didn't have to use it!)

We ran off of batteries, being charged by a 28 watt solar panel. (I found the lack of generator noise to be very nice.)

I provided my Idiom Press CMOS Super Keyer II for the CW operations. The other two CW operators hadn't used a memory keyer before, and I think they are converts now—they both expressed interest in building their own.

We logged to an old, tiny, Sharp sub-notebook PC, using WR9Y software—it was a great program. We also logged to paper, Just In Case.

I haven't gone through the logs yet, but we made approximately 260 QSOs, mostly on CW. I don't know if this is a good score—I'll have to wait for the QST results in November—but we felt good about our effort.

We set up after 1800z Saturday, to take advantage of the 27 hour operating period. We were very surprised to hear that the bands just shut down at 1800z Sunday, so the extra three hours we had were very unproductive. It appears that maybe we should have set up early. I speculate that most of the groups set up early, so they can't operate past 24 hours.

72, Eric. WD8RIF

AB5OU Field Day Exercise

By Tim Pettibone, AB5OU
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Had to stay home but operated my new QRP+ off of battery power. Antenna was Zepp up 15' (about 6-7- ft long, who measures?). Yep, the QRO stations weren't listening real good. Worked 60 in 33 sections in around 10 hours of operation all on 40/20m. Even snuck a few casual q's in on 30m! Had fun, already sent in my log to ARRL! Love my QRP+!

Tim AB5OU

G5RV Comparison on Field Day

by Bob Hightower, KI7MN
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Well, with all the discussion on the effectiveness of the G5RV on 30 meters, and with Field Day being the perfect opportunity to string antennas, I used two antennae, at right angles to each other, one HB and one commercial, both 40' or better off the ground.

The HB antenna did indeed tune and work well on 30 meters (using a TS450SAT), while the commercial antenna did not. Hmmmmmm.... both are cut to the same length, and, purportedly, use the same wire. Only difference is in the center insulator. Obviously

there is some other electrical difference that I don't have the expertise, equipment or time to measure.

Anyway, it seems that, with a good tuner, the G5RV will work on 30...maybe. Nothing definitive here, at all.

I strung the two antennas up at right angles as an experiment, using an antenna switch, to see what the difference in propagation would be for the states to the north of us. Not much, really. Some of the calls to the Eastern states were made with the wrong antenna, with better reports than from those on the antenna oriented that direction. But, there were no problems noted, seemingly no coupling of any kind, even though the ladder lines/feed lines were somewhat close. One benefit was that if I couldn't hear a station, I just flipped the switch, and, in most cases, there they were, much better. Have to do this again.

Also strung up the Bic Flamethrower. What a little jewel this is. Working with both the QRP+ and the NorCal 40A, it was an absolute wonder. Light, easy to erect and very easy to tune, this one is a keeper.

Hope all had a good time on Field Day, as we did at about 8000' in North Central Arizona. Look for you all at the fall QRP Afield.

73 Bob KI7MN

NN9K Field Day Results

by Peter Beedlow, NN9K
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Call: NN9K
Class: 1B (2 operators: K9WA & NN9K)
Section: IL
Power output: 5 watts. CW only

Band	**QSO's**
80	95
40	151
20	228
15	54
TOTAL	528

Equipment and antennas:
Radio: Icom IC-735
Antennas: 2 McCoy dipoles at 65 feet and 1 old, 1957 vintage tribander, at 20 feet.
Logging: Laptop powered from station battery supply runninn NA.

Ought to be more operating events (read: contests) that allow QRP power with single transmitter and 2 operators. Very relaxing!

Hope you all had fun,
72/73, Pete, NN9K

N9RJ Field Day Report

By Russ Johnson, N9RJ
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My plans to get the club to use my new QRP+ for Field Day didn't work out too well. The others wanted to use a REAL rig ie Kenwood TS-690. That was ok I guess even though they should have at least given the QRP+ a try. They started out at 5 watts but it wasn't long before the were turning the power up to 15 watts then to 50 watts so I said why stop at 50 just turn the thing up to 100 watts and forget QRP so they did.

When my turn came to operate I fired up the QRP+ and it really worked great. I don't have the log sheet printout yet (used PC with CT logging program) so can't recap the numbers yet but I had very good success on CW. I didn't try SSB as I was the only CW Operator this year.

My first session was 2:00 to 4:30 am Sunday morning on 80 Meters. Ran at about 25 per hour rate with one half hour with 25 contacts. It was all search and pounce as calling CQ didn't seem to net as many contacts. About 6:00 am Sunday I tried 40 for a while then the phone guys took over again.

There were two guys interested in the QRP+ and were very impressed with it but would not operate the EVENT (see Chuck, I remember it's NOT a CONTEST! hi hi). We did play around on 30 Meters a bit but the receiver was not happy with the other rig on 40 so next year I think I'll try band pass filters for 30, 12, and 17.

We had a fair turnout of ops, only a few hours of rain, and only one BIG thunderstorm (2 inches of rain in 40 minutes) so another sucessfull Field Day.

Hope you all had fun too. 72, Russ Johnson N9RJ

FD '95 and More

By Preston Douglas, WN2V
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. I had four friends punk out—and it rained. So operated 1E alone at home and made 81 QSOs operating a few more hours than Nils (who easily takes first place for the best FD report.) Made 40 of the QSOs with the SW80 (Hello, Dave Benson, the new 2N3553 did the trick and it puts out a solid 1.5w. Must have blown the original with the spurious junk caused by putting the wrong toroid core in the xmt bfo. Thanks for the help.) Another discovery: RIT is not needed for FD!

No question, the CMOS II memories were the best anti-fatigue, anti-error aide ever. I will never contest again without it. Unpaid endorsement: The CMOS II by Idiom Press (see any QST, I don't have the address handy) is easily the best buy out there in memory keyers. I programmed one memory with the exchange. One had a FD CQ. One just my call sign (sent the exchange while logging—even grabbing a sip of caffeine—very easy.) Made only two QSOs calling CQ. That's about the right ratio—one out of forty QSOs calling CQ with one watt.

Ran all battery with SW80, NW80/20 on 40m, Explorer20, and old Digitrex on 20M SSB (one lousy phone QSO). .. and took a lightning hit. It made a six inch scar from 40 feet up my big tree down the bark into the ground, and underground to my gas line (no explosion, thank God.) Due to impulse/induced/ secondaries (who knows), we lost two tvs (just out of warrantee), two computers (warranteed) one phone and one alarm system, assorted light bulbs, and one GFI protected outdoor electrical circuit. Scared the crap out of us at 3am. Obviously, I wasn't operating. (I'm too old for all night contesting.) Rigs were grounded and d/c'd from all antennas, so no damage in the shack. I leave 'em that way when not in operation. You should too. Funny how it hit that tree 65 ft from my tower

(attached to the back of the house) which is kept cranked down to 30' and is well grounded. Maybe it (the tower) protected the house under its umbra.
Preston WJ2V

FIELD DAY - No Challenage for my QRP!

By Dennis Marandos, K1LGQ
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Field Day is over and I lost! I didn't just lose, but I went away weeping. My QRP rigs were NO match for the big guns out there in KW land. I set up a station in Holderness, NH (Golden Pond) on Squam Lake and pitched three dipoles. I was on 20 and 30 and 40 meters, which was great. I had my extra car battery charged and ready for some serious number crunching activities. I was going to make some big scores on this contest if I had to stay up all night doing it.

When two o'clock in the afternoon rolled around, I was just finishing my last dipole. I ran into the shack (a screened area facing the lake) and 'got on.' Now the big BUT of contesting. I could hear them, but they couldn't hear me. I made two contacts (15 seconds a piece) in two hours. I was frustrated! I, for some unknown reason, brought my TS-450SAT and tried to make a few points with higher power. I filled 8 pages!

I believe the playing field is pretty loopsided with QRP and that the real contest will be this September 16 with QRP AFIELD. In that contest, the playing field will be level and all the players will be using the same tools. It's going to be a contest for QRPers, and not QROs!

As with all contests, there is the weather factor. On Saturday the WX was in the 80's with a gently breeze coming off the lake. When the contest was winding down, I could hear thunder in the background. At 1:45 EDT Sunday, I thought it was about time to remove the dipoles off the trees. I got all the wires down, the rigs all packed away, the car loaded and headed for the dirt road. Three minutes on the road, from the cabin site, the sky opened up and Armageddon poured for an hour of steady monsoon rain. BUT, I didn't get wet!

I am looking, no I am gunning, for the QRP AFIELD in September! Watch out RF, here I come. Dennis - K1LGQ
Editor- New England QRP Club newsletter

NORTEX FD

By Henry Smith, NA5K
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I would classify the NORTEX (North Texas) QRP Group Field day outing as a success. We set up in a little park in Richardson Texas.

Antennas:

Loading up the rail road track that ran beside the park seemed to work but we encountered problems every time a train came by. It seems that when the road crossing gates went up, our antenna become rather discontinous.

So we loaded up the celluar radio tower that was on other side of the park.

After virtually shutting down the North Dallas celluar corridor, we decided to revert to our back up antennas which was a pair of 140' long wires at 90 degree angles (no

kidding). This gave us good coverage.

Participation:

We had 6 to 8 participants during the more sane hours and had 4 all-nighters.

The big push was to have a good time and to allow some of our less-experienced CW ops to have a go at a contest. We had success in both catagories.

A note to Dennis, K1LGQ:

You are correct, it was tough, especially right after the starting gun. But using a few tricks, you can level the playing field and make lots of contacts. More on this next year.

Thanks to all who came out.

Smitty, and the NORTEX gang.

It's A Dupe!

By David Johnson, WA4NID
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Here is a true account of a really (at least to me) hilarious situation that happened when I went to visit the CFD (Chatham County Field Day) this past weekend. It was in the first hour or two of Sunday morning, local time. Paul Stroud, AA4XX, was kind enough to show me the 40m cw qrp station (connected to phased verticals) and to let me operate awhile. Bob, KE4NBC, was dupe checker at this position, and he stayed on while I began to operate. Paul was hanging around either in the tent or just outside for awhile, and I was using the headphones as a speaker (like I do at home a lot with the Sierra). I was using a pencil to copy calls and then told them to Bob, who checked for dupes. Paul was copying in his head, and several times would say "it's a dupe" immediately upon hearing the call.

Well, I don't know how long he had been operating at this position, but it seemed that he had a good short-term memory, as he was invariably correct in these pronouncements.

Ok, now for the funny part. Seems like six or seven times Paul made these judgements (correctly, as determined by Bob's checking the dupe sheet), and Paul wanders off from the tent. I keep operating with the headphones as speakers, and copy another call. Way off in the distance I hear this faint voice, a barely discernable whisper: "it's a dupe"! I looked for Paul and he had disappeared in the darkness, but must have been 50 feet away!

Not only did he correctly remember all those calls, but he was copying the audio from the station when he was halfway across the field! I started laughing uncontrollably, and Bob did too (sorry to WA3ULH, Rob, operating in the same tent at another rig, who suffered some local qrm!), because we were straining our eyes in disbelief, trying to determine how far away Paul was! There wasn't too much light on the field, but that audio sure must have been weak in Paul's ears! Of course, when Bob checked the sheet, sure enough it WAS a dupe.

I went on to work some more stations, and had a great time operating. But the best part was the incident described above, when Paul demonstrated both his extraordinary short-term memory and his exquisite ability to copy the weak signals, with that unforgettable phrase from across the field: "it's a dupe!"

Have fun hammin'! Dave, WA4NID

N2JGU QRP FD95

By Gary Diana, N2JGU
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Brad WB8YGG and I got together for a third QRP Field Day. We setup a tent, operating table, etc so we could operate the whole weekend regardless of the weather. We operated as N2JGU 1B WNY, QRP of course. Our QTH was approximately 40 miles west of Rochester NY.

Equipment:

TenTec Argosy 80-10m SSB/CW
HB Sudden RX/ Cubic Incher TX for 80M CW
HB Epiphyte 75M SSB + 5 watt amp
HB NN1G 80m CW
Misc. 2m fm equipment

We put up a 80m ladder line-fed dipole at about 35'. The site had just enough trees for the dipole, and had a great view toward the southwest. We setup Friday afternoon, and were getting S9 to 20 over signal reports from Ontatio Canada, NY and PA on 75m Side-band at QRP power levels.

We made about 300 contacts (290 more than last year!), split 50-50 between SSB and CW. Most contacts were on 80m and 40m, with a few on 15m and 20m. One interesting note was that few things had to be repeated on the CW contacts! Was it better OPs, or the conditions? On Saturday morning we cobbeled together a 4 element "Fred Flintstone" 2m Quad with #12 house wire, straight out of the Antenna Handbook. It worked like a charm, but looked pretty primitive. That gave us communications back into the local Rochester repeater.

We went through two gel cells with the Argosy, and had a solar cell going which allowed us to monitor 2m for free. The wx was in the high 80s/low 90s and it was HU-MID. A rain storm cooled things down for a while on Saturday, but then the high humidity returned. Brad took some digital pictures with a camera he borrowed from work, and they should be appearing on the Internet soon. All in all we had a great time and have some ideas for a better FD next year. I guess it's back to reality now as we re-pay our wives for letting us get away for a radio weekend!

73 Gary N2JGU

NORTEX FD - What We Did

By Henry Smith, NA5K
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We are not the experts, this was our first Field Day. But we did sit down and think it out before we started.

1. Put up the best antenna that you can get in the area. Mike Dooley, KE4PC, was the antenna chairman. All antenna credit goes to him. We put up two 140 ft long wires which were perpendicular to each other. We used 3 20 ft poles for this. The antennas went right into the tuner, nothin' fancy.

The idea was to position the lobes of the 2 wave 20 meter longwire pointing to the NE, NW, SE and SW. The nulls were due North and South. This gave us some gain in the directions we wanted. The lobes of the 1 wave 40 meter longwire were not as pronounced but they were there never-the-less.

Mike kept track of the contacts on a map of the US and his predictions were righ on,

we worked 'em where we expected to. We could have gotten by with one antenna.

Remember, you are competing with beams on 20m, so you need to level the playing field a little. On 40 and 80, most stations use dipoles or verticals. Not as hard to compete here. Much more could (and probably will) be written on this subject.

2. We didn't start on 20 meters. What a mess that was! After we heard that, we went down to 40 meters where there were fewer stations. Just about everybody starts on 20. Later on when we felt that the crowd would be moving to 40, we went to 20 and stayed there until late in the evening. Then we went to 40. By Sunday morning, it was all dupes Also, 15 opened up for a while. Go where most stations ARENT. Actually if you didnt start until 1900 or 2000 UTC it wont hurt. Let the riot subside a little.

3. We didnt bother with calling CQ. Forget it if you think that you can hold a freq! We started at one end and gradually worked our way to the other end. If the station didnt hear us after 2 or 3 calls, we moved on. Finesse and patience.

4. Other:

Most stations cook along at 25-30 wpm, live with it.

If not sure, call any way.

Take breaks.

By dinner time on Saturday, your hotshot ops are hungry and go to din-din. Thats when they put in their new guys. That when our slower ops did their best.etc.

Saturday, some of our less experienced CW ops jumped in there and made some contacts. As they gained experience and speed, their contact rate increased. By Saturday night, they ran the show and milked 20M and 40M dry.

We aren't the experts and probably didn't place but just about every body made q's and had a good time.

Smitty for NORTEX
Henry Smith (hbs@crl.com)

KC4EWT FD: Fuse the Battery!

By Dan Johnson, KC4EWT
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Having participated in club FD activities in the past, KC4EWT's tiny shingle wafted gently in the ionospheric breeze for the first time. The effort was rewarded by satisfaction which exceeds the contest score.

The goals were to make and test fixtures necessary to run from battery power and to operate a QRP FD station. Lessons learned:

1. FD can be done without widowing the family.
2. QRO FD is too easy, QRP puts the spice back, though it's easy (essential, perhaps) to forget that you're QRP because it doesn't matter as much as you'd expect.
3. Less important than power is hitting the sweet spot of the other station's receive filters.
4. It takes more time and planning than expected to convert one's station from power mains to battery power.
5. Fuse the battery (hi).

Locating the station in a sweaty but nearly bug-free wooden shed in the backyard provided less than optimal operating conditions while maintaining the ubiquitous balance between hamming and family responsibilities.

In QRO (100W) years past, I could snare most anyone I could hear. That wasn't the

case with QRP, but with surprisingly few exceptions, it seemed like the most influential factor was whether my 5W hit the right part of the receiving station's passband. Excursions of +/-400 Hz from apparent zero-beat often netted contacts. I conjecture that this was necessary either to get all of my signal inside their passbands or to hit the right audio pitch in their earphones. With a 250 Hz IF filter, RIT proved the most important transceiver feature.

A single deep-cycle marine battery, one of twins acquired to feed 24V to boatanchors, powered the event with plenty to spare. Construction projects included a power distribution box, cables, and a light source. I was too hasty constructing the power cable for the tuner meter's lamp. The coaxial power plug's terminals shorted near the end of FD, and the fried conductor acted like a toaster instead of a fuse, hence the lesson above about fusing the battery.

The ICOM 745, internally tweaked to run 2W minimum, ran 5W throughout the contest. This was my first opportunity to measure its power consumption. With a dead meter light, it drew 0.95A RX and 5.4A TX. For me, this emphasizes the distinction between ricebox and "true" QRP technology.

In 60 contacts over 7 operating hours with 5W on 40M and 20M, I worked 33 sections in all but call district 3, spanning the U.S. in every direction and including 3 Canadian sections. Not spectacular, but not disappointing, either. There were some good ears, with good operators between then, out there. I only worked one other "B" class, K9OM, but plenty of others were out there working "turf" stations.

KD4DFD dropped by to try his hand after 2000Z, but by then it became difficult to find contacts amidst QSOs.

Bottom line: despite the limited operating time and a "miserable" score by competitive standards, it was well worth the effort and well worth repeating.

My expectations this year were realistic resulting in no dissapointment. Next year, I'll expect to put a more efficient HB transceiver on the air and to improve the score from this year. One step at a time, guaranteed pleasure.
72 de KC4EWT EWT 1B 1B VA VA TU

Zuni Loop FD Report

By Doug Hendricks, KI6DS
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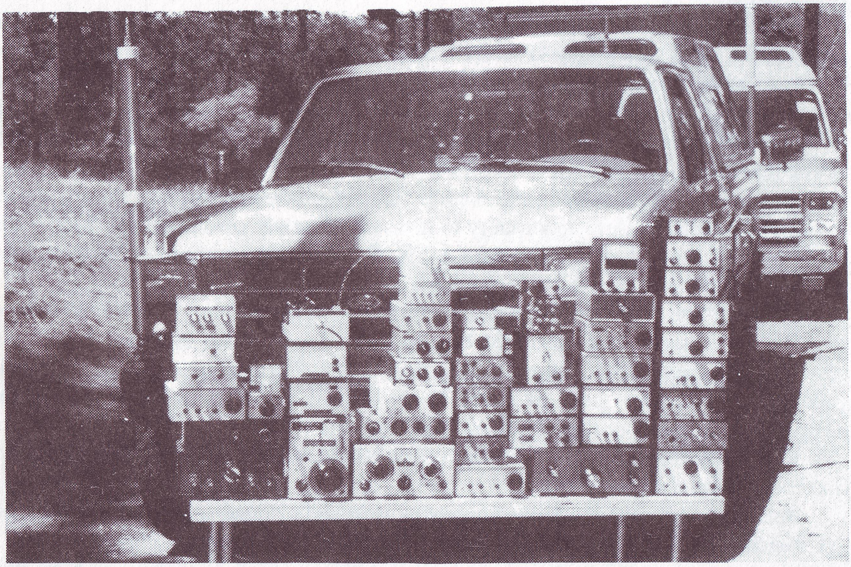
The eleventh annual Zuni Loop Mountain Expeditionary Force made their assault on Field Day from the Zuni Loop of the Table Mountain Camp Ground near Wrightwood, California. The campground is at an elevation of 7200 feet, and has a clear shot at the East. It is located about 50 miles Northeast of Los Angeles and is at the tip of the Sierra Nevada range.

The Zuni Loop Mountain Expeditionary Force was started in 1985 by Bob Spidell, W6SKQ, (who became a silent key in 1993), Fred Turpin, K6MDJ, and Cam Hartford, N6GA. It has always been a QRP Field Day operation, and has grown in size as the members have invited guests, who in turn have returned and invited others. The way that it has worked is that the first time you are a guest, and if you prove to be compatible with the group, then you become a member of the Expeditionary Force.

I first learned of the Zuni Loopers by reading accounts that were published in the QRP Quarterly, the Journal of the ARCI. Those accounts were like feeding candy to an orphan, I wanted more and I wanted to be part of it. It became a dream of mine, to go to

Field Day with the Zuni Loopers. Then, in the spring of 1993, I came in contact with Richard Fisher, KI6SN who just happened to be a member of the Zuni Loopers. He invited me to attend, and I have been going back evei since. It is like Dayton, once you



Zuni Looper FD Equpment: Most of the equipment in this picture is home brew. The only rigs that are not are 2 Mizuho transceivers and an MFJ SSB rig. All of the rest are rigs and accessories that were used by the Zuni's in their 1995 FD assault from Table Mountain Campground.

have been, you have to return.

The Zuni Loopers have been through a lot in their trials and tribulations of fighting the Field Day Wars. Bears have raided the camp. There was an earthquake one year, and in 1994 there was the Wrightwood Forest Fire that was only 2 miles from the site. It burned for several days before it was brought under control. But through it all, the Zunis have prevailed.

This year there were 17 operators with a total of 75 years of Zuni Loop experience! Here is the list:

Fred Turpin, K6MDJ - 11 Years
Cam Hartford, N6GA - 10 Years (he missed on his 25th wedding anniversary)
Keith Clark, W6SIY - 9 Years
Rob Roberts, N7FEG - 9 Years
Richard Fisher, KI6SN - 6 Years
Ralph Irons, AA6UL - 5 Years
Kim Irons, KD6WJK - 4 Years
Clark Turner, WA3JPG - 4 Years
Doug Hendricks, KI6DS - 3 Years
Charlie Lofgren, W6JJZ - 3 Years
Wayne Burdick, N6KR - 3 Years

Tom Brown, W6JHQ - 3 Years
Vern Wright, W6MMA - 1 Year
Jon Iza, EA2SN - 1 Year
Tony Gasparovic, N6OAT - 1 Year
Paul Carreiro, N6HCS - 1 Year
Bob Heusser, K6TUY - 1 Year

Fred operated 40 meter CW along with Tony and Paul. Cam, Keith and Wayne were on 20 and 80 CW, while Clark held down 15 CW and Phone and Rob did the same with 10 CW and Phone. Richard operated 2 M simplex, Tony and Paul helped with 2 M packet. Clark also did some 6 M phone and 1 6M CW contact. Ralph had the 40 SSB station, and Vern and Doug worked 20 and 75 SSB. Tom, Jon, Kim and Bob logged and Charlie (who is better known in Zuni circles as Charlie Tuner, was in charge of the tuners).

The Zunis are serious and famous for their antennas, and this year no exception. Here is the list, and please don't drool when you read this.

2 Meter Simplex	5 Element Homebrew DNA Quad. (Richard cut his thumb while building it, and it took 3 stitches to close the bloody wound. If he would have been involved in a criminal activ ity even the LA police would have had plenty of evidence.)
2 Meter Packet	Stacked Yagis, Top 4 element, bottom 3 element.
6 Meter Phone & CW	Dipole at 60 Feet.
10 Meter Phone & CW	Homebrew ZL Special, 2 element beam.
15 Meter Phone & CW	Homebrew ZL Special, 2 element beam. This is the W6SKQ Memorial Antenna. Bob Spidell built this antenna, and it is priceless to the Zuni Loopers. Bob watches us every year, and he is pleased that we think of him when we see his antenna.
20 Meter CW	6 Shooter. Made of 6 phased dipoles at 100' Dipole at 50'
20 Meter SSB	5 element Yagi at 55 feet on a rotatable Army Surplus tower. Skelton Cone at 40 feet.
40 Meter CW	3 element Inverted V Beam at 80 feet.
40 Meter Phone	Inverted V at 50 feet.
75 Meter Phone	Skelton Cone at 40 feet (same antenna as 20 meter phone, fed with homebrew ladder line and a tuner) Half Square at 62 feet. Half wave horizontal element (128') with quarter wave vertical elements.
80 Meter CW	W8JK which is 2 parallel full wave dipoles that are phased with 1/8 wave spacing at 90 feet.

Thirteen antennas, and what an antenna farm. Even Vern, W6MMA who has the best antenna system that I have ever seen was impressed. It took several hours to erect them, but boy is it worth it. The old sage about the antenna being worth 99 times more than power is certainly true at QRP levels. The question many of you are probably asking is how do they get those antennas so high? It is simple my friend. Table Mountain has hundreds of pine trees that are over 120 feet tall. The Zunis use a modified slingshot called a Wrist Rocket. They have added a Zebco 33 fishing reel to the front by clamping two 3/16" rods to the slingshot with cable clamps, and then mounting the fishing reel to the rods.

Fred Turpin is a master at shooting 3/4 ounce fishing sinkers over a tree limb. In the past Fred has used 4 lb. monofilament line, but this year he used 6 lb. test and it worked much better. Fred shot 2 antennas for me, and both of them were done the first time. The

process is simple, first the sinker and monofilament line, then heavy nylon string, then a small rope, if needed, with one line pulling up the other in sequence.

What about rigs? This year the Zunis decided to concentrate on using homebrew rigs. This was brought about by the emergance of all the great kits in the past 3 years. Here is a list of the rigs and homebrew accessories that we had at Field Day this year. We took a picture of all the rigs on a table, and you will get a chance to see it as it will be published in QRPp.

OHR SCAF Filter
OHR Sprint 30 Meters
OHR Sprint 40 Meters
OHR Explorer 40 Meters (2)
Cascade SSB 20 & 75 (2)
Epiphyte SSB 75 (2)
MFJ 9420 SSB 20
OHR Classic 20 & 40 CW
OHR WM1 Wattmeter (2)
CMOS Super Keyer II (4)
Sierra (4)
Homebrew 20 & 40 Meter Transceiver
SWL 40-40
Mizuho 40
Mizuho 6
St. Louis Tuner
NorCal 40 (4)
NorCal 40A
Homebrew Paddles
Junction Box
Z Match Tuners (5)
R2/T2 (Hands Linear, T2 Transmitter, R2 Receiver, Differential T Match, Low Pass Filter, W1FB Universal VFO)
Curtis Keyer (2)
HW-9 (2)
Argonaut 515 (4)
Yaesu FT 890
Yaesu FT900
Neophyte Receiver

Icom 502
HTX 202
Kenwood TS140
Army Surplus 55 Foot Rotatable Tower

As you can see we had quite an array of equipment, with 90 percent of it homebrew. How did we do? Well, we made 1039 contacts, and we think that we were in Class 6A. Cam will go over the logs and determine our exact class. Our point total was over 8000. The all time Zuni record for Qso's is 1199 set in 1993, and it was our goal to break it this year. But, we fell a little short. One of the problems that we had with the home brew rigs was that the Sierra was interfering with the Cascade on 20 and 80 and the Cascade was likewise getting into the Sierra. The front ends need to be beefed up if they are going to be used in a field day type of situation. The Cascade that we were using did not have the RF gain control hooked up, (prototype), and we certainly could have used it. This is a call to all of you. Someone needs to design some type of filter to keep the two rigs from bothering each other when they are used in close proximity. Even with the RF control on the Sierra, the interference from the Cascade was still there. Plus by turning the RF down so far, the signals were being attenuated by 30 dB!! To solve the problem, we started trading operating time, with the CW stations going for an hour and the SSB for an hour. Then when 75 opened, the 20 SSB station closed and we worked 75 SSB and 20 CW with no problems.

It was great fun and I certainly enjoyed the weekend with the Zunis. It was worth the 300 mile trip one way. I will be back next year. 72, Doug, KI6DS

K3WW QRP+ 1BBattery 1 OP

By Charles Fulp, Jr. K3WW
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Call & Class:
K3WW 1 B Battery, 1 operator

Location:
Pennridge High School Field (50 feet from my drive way) The location, close to home, in a valley, a hill to the north rises 300 feet in about 1/4 mile, other directions are not obstructed for some distance.

Equipment: QRP+, Azden mobile 2 meter radio, Icom HT and PacComm HandiPacket, Laptop computer. Gel Cells and Deep Cycle Marine batteries for power, plus fluorescent battery powered lamp to view LEDs. (The past 4 years I just used the glow of the screen and display of the IC 751A.)

Antennas: 80 40 inverted V dipole, center about 55 feet up on fold-over/telescopic mast of my own design. 20/15/10 dipole (the 40 dipole worked better for 15) single feed line center supported on same mast at about 50 feet. Hustler mobile antenna on van used for a few QSOS, 2 meter whip for 10 VHF (2FM) QSOS., rubber duckie antenna for packet.

Results:

80 CW	278
40 CW	237
20 CW	124
15 CW	64
Packet	90
2 FM	10

Looks like 7,980 points for contacts, plus most of the Bonus points except for Satel-

lite and (blush) Natural Power. The receiver in the QRP+ worked fine, it was never the limiting factor in making contacts. Had very high noise on 20 and above at times, but 80 was extremely quiet this year. I use dipoles because they are simple, and predictable. I think the energy needed to put up a beam or more complex antenna system would be counter productive to the operating portion of the event, for a 1 man operation.

This may be very close to a new 1 B battery 1 Operator record, I couldn't break it with my IC751-A, but more guys were on packet and conditions were close to ideal for my set up. The 5 multipler, in my oppinion puts QRP stations at an insurmountable advantage in Field Day, if point totals are important to you. Some day it would be fun to go for the all time point record, with a good QTH, big antennas and a dozen or more QRP stations. 73, Chas.

NorCal QRP Field Day in the Santa Cruz Mountains

By Stan Cooper, K4DRD
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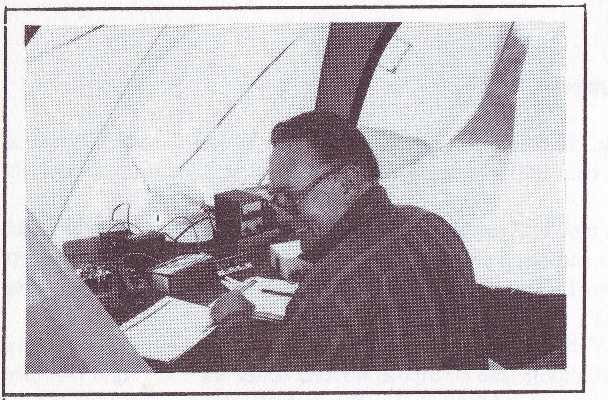
Dave Meacham, W6EMD, (pictured below) sent me an e-mail about a week before Field Day asking about my plans for the weekend. Dave mentioned that he, Eric Swartz, WA6HHQ, and Stan Goldstein, N6ULU, were planning to set up a two position operation atEagle Rock, an inactive Forestry Service fire lookout at 2800 feet above sea level just off of the Empire Grade in the Santa Cruz mountains. Eric and Stanhad used Eagle Rock previously, and as Eric described it, the site was a relatively flat circular shaped mesa about a hundred yards in diameter, with the lookout tower in the middle. The view in all directions was spectacular, with the Pacific Ocean to the west and Mount Hamilton on the horizon a couple of ranges to the east.I hadn't participated in Field Day activities since the late sixties, and readily accepted Dave's invitation to join the group. A couple of days later,Stew Bowers, WB6FBB, called to ask me about my plans, and he joined us as well. Lloyd Cabral, AA6T, had graciously agreed to let us use his call sign for the operation. What a great CW call!Leaving Redwood City about 8:00 AM, Dave and I caravanned to the site with both our cars loaded to the hilt. Eric and Stan spent early Saturday morning disassembling a 30 foot mast and loading it and a full size three element 20 meter Yagi onto Stan's pickup truck. Dave kept in touch with them via Eric's 440 repeater, and briefed me on their progress via 2 meter simplex (I've got to get on 440). We all rendezvoused at the gate to the site about 10:00 AM Saturday.At 11:00 (1800 GMT) sharp, I set up the Outbacker whip with copper foil radials and a solar panel powered Sierra on forty, and by 11:10 was on the air. While I was operating, the rest of the group raised the tower, secured it with three guylines, and Eric climbed to the top and installed the 20 meterYagi pointed due east. It wasn't long before the second position was up and



running on twenty using Stew's Sierra Next, we assembled and erected a 40 meter inverted vee wire "beam". For this antenna, we separated the driven element from the reflector with a twenty-two foot boom which was at the top of a thirty foot mast. Again, we pointed the antenna east. With the forty meter operating position at a new location closer to the inverted vee, we resumed operation. The wire beam's performanceon forty was outstanding, and as an added bonus it resonated on the CW end of fifteen meters as well.Although the group was pretty "laid back" with the primary goal to have a goodtime, we managed to log about 350 CW and a handful of SSB QSOs for about 3500 points. Saturday evening visitors included Eric's XYL, and Lloyd, AA6T. In all, two NorCal Sierras, Stan's NorCal 40, a Ten Tec Argonaut 505, a Ten Tec Scout (set for QRP), and a Kenwood TS-50 (also set for QRP) were used on HF. Eric also set up a packet station on 2 meters, and we had several 2 meter simplex voice QSOs. In spite of soaring temperatures, hordes of mosquitos, a little poison oak, and a less than stellar score, Field Day was a great success for all of us. We can hardly wait 'til next year!

72, Stan, K4DRD

Grounding and Random Wires

By Jay Coote, WB6AAM
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What do I think of random wires?... hmmm, this will be a long one. Be patient.

Length:

There is too much fuss about length. If the antenna is around 1/4 to 1/2 wavelength at the lowest freq, it will work effectively on that and all higher bands. Old ham texts about 67' or 134' of wire date back to the 1930's and 40's when the PA tank circuits connected directly to the antenna (no coax). The antennas then had to be specific lengths. 50-60 years later we have NINE bands and tuners. Whatever length works with your tuner on all
nine bands is "the" length.

Antenna pattern:

A random wire will probably be used in temporary, concealed or other less-than-perfect sites where ground or nearby objects interfere with the pattern. In the clear, a straight horizontal wire run will behave similarly to a horizontal dipole. If the length of a straight random wire is several wavelengths, lobes develop off the ends of the wire. The longer the wire at frequency, the more directive off the ends. Random wires many wavlengths at
frequency are called longwires and have been used for their directive properties. A typical random wire, 50' to 150' in length and 30' above ground will generally have medium and high-angle properties on the lower HF bands; high and medium angle properties on the high HF bands. I have also deliberately kept wire antennas below 30' above ground for high-angle work (NVIS) on 1.8-7 MHz.

Portable/Emergency/Concealed use:

The random wire lends well to these operations because there is only a single, thin conductor to deal with (no coax or balanced line). The antenna may be thrown over roofs or trees. It may be dropped from a high-rise balcony. It may be shaped like "V", "L", "sloper" or other antennas with similar performance. The random wire requires fewer supports than coax-fed or balanced antennas.

Ground or Counterpoise:

The random wire must be operated "against" a ground or counterpoise. (You wouldn't feed just half of a dipole). Hams have to remember that the counterpoise for a random wire is like the "opposite leg" of a dipole...it should be treated as a radiator. Large ground rods in the earth may be suitable for VLF or lightning protection, but are not as efficient at HF. (Compare a dipole to a 1/4 wave vertical with a ground rod). The length of the counterpoise wire (s) may be whatever works with your tuner and antenna on all nine bands. Some people will use a 1/4 wave radial for each band which produces a "hot" tuner chassis. Some have used a counterpoise which lies under the length of the flat-top portion of an L-shaped random wire. The counterpoise under the antenna is said to improve on high-angle work by acting a little like a reflector in a beam antenna.

A few hams have used an MFJ "Artificial Ground" which is simply a series L-C tuner connected between the GROUND terminal of the tuner and the counterpoise. It is said that tuning the counterpoise keeps RF off the chassis and may improve the radiated signal. With the antenna up and in place (especially a concealed antenna) it may be easier to play with the counterpoise length to get the system to work on all bands.

Drawbacks of random wires:

In some concealed and temporary installations, part of the antenna will be indoors or will run close to the plumbing, wiring, utilities or metal mesh in the building. In comparison, a center-fed antenna and TV or ladder-line will get most of the radiating portion of the antenna up and away from the building.

Tuners for random wires:

Most ham tuners for sale, or magazine projects are variations of the T-network. With sufficient L and C, the tuner should cover 1.8-30 Mhz with a few tries at finding a wire and counterpoise length. Useful L might be 0-25 uH. Useful C might be 0-200 pF. Some poor tuner designs don't have the L/C to load a random wire, let alone a dummyload under 7 Mhz. Another good tuner which is very easy to build is the L-network. The L uses a series inductor and a shunt capacitor at the output. You don't have to isolate the cap, as it's case must be grounded to chassis. I once built an L-tuner for QRP-CW out of a 360 pF variable cap and tapped inductor.

Bottom line:

Disregard ancient texts about exact length. With your tuner, a 110' wire will work as well as a 140' wire. Experiment with antenna and counterpoise length. Treat your counterpoise or radial(s) as a radiating part of the antenna rather than an electrical ground. I am in a temporary location and I am presently using a 120' to 140' (who's measuring?) wire about 20' average height above ground. The tuner is an MFJ945D and I have also used my homemade L-tuner. My ground is a water pipe (boooo!). It's not a DX blaster antenna but I can make contacts on ALL bands.

72 Jay, WB6AAM (ARCI 5050)

Transceiver Alignment and "What does it mean Alfie?"

By Chuck Adams, K5FO
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Let's talk about several related things — transmitter and receiver frequencies. These two may or may not be the same at any time or at all times and then again they may be the same all the time. Confused? Good, then I can help you out.

First of all lets look at a transmitter or signal source at some freqency within amateur bands and let us call it f(0), where the f(0) will be f-sub-zero or f-sub-naught depending

upon your view in the fine art of mathematics. I'm limited in this article by typing things in ASCII so I will be using some notations that would be much simpler with subscripts. So for the sake of discussion, let f(0) be 7.040MHz. If the transmitter is on and it is a pure sine wave at f(0), we might plot a frequency spectrum graph like:

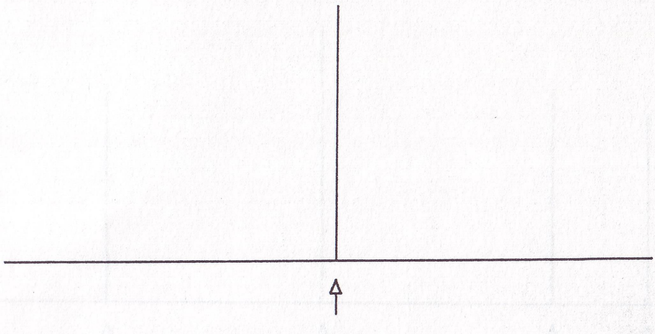

Fig. 1

where the height might be proportional to the amplitude of the received signal in a receiver. Here we are not concerned with the strength, just that it exists and we can hear it on our transceiver. Now the above graph means that we are emitting only 7.040MHz and no other frequencies; no second harmonics, third, or N*f(0) where N=2,3,4,... An ideal case, but understandable.

OK, let's look at the receiver signal chain, simplified for a single conversion superheterodyne. The signal comes into the front-end and goes through the first mixer where we have a LO (local oscillator) that varies over a range for say 50 KHz. Let its frequency be f(1). We will get out of the mixer the frequencies f(0)+f(1) and f(0)-f(1) and some other stuff, but we are interested in only one of these and this is how we home in on what we want. We use a filter after the first mixer, called an IF filter, because we are going to get an Intermediate Frequency between the two we are mixing (usually). Let's take the IF to be 4MHz for two reasons; 1. it makes the mathematics simple and 2. we can buy some real cheap crystals (but not too cheap) at this frequency.

What we want is f(0)-f(1) to be 4 MHz. f(1) is called the VFO (variable frequency oscillator), so if we want to listen to the transmitted frequency at 7.040MHz then the VFO must be at 3.040MHz to give us f(0)-f(1)=7.040MHz-3.040MHz=4.000MHz. We will also get f(0)+f(1)=10.080MHz, which we don't want and gets eliminated by the IF filter following the mixer. We now have moved our received signal to another frequency range internal to the receiver and we start to do stuff to it. We probably want to amplify it using an IF amplifier, say a MC1350.

Our spectrum graph may now look like Fig. 2 (I won't go through all the gory details of relative strengths of each of the resulting components I'll save that for another 100 pages later on.)

At this point and time none of us can use the 4.000MHz signal to hear anything. We need to get it to an audio range, so we pass it through another mixer, which we will call a detector, because it will allow us to "detect" the signal, i.e. hear the signal as an audio tone. So what we have is another mixer with a LO, but this one will not vary in frequency.

Let's say you like to hear CW at a tone of 600 Hz. We will make this LO 3.999400 MHz. The output frequency from the mixer will be f(2)-f(3), where f(2) is the frequency through the IF filter into the detector and f(3) is the LO frequency of 3.999400 MHz. Thus 4 000000 MHz - 3.999400 MHz = 600 Hz.

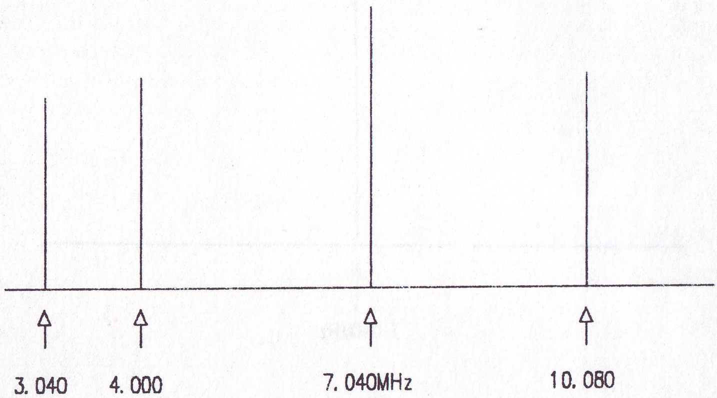

Fig. 2

This we will pass on to an audio amplifier, say a LM380 or LM386. The diagram would look like Fig. 3.

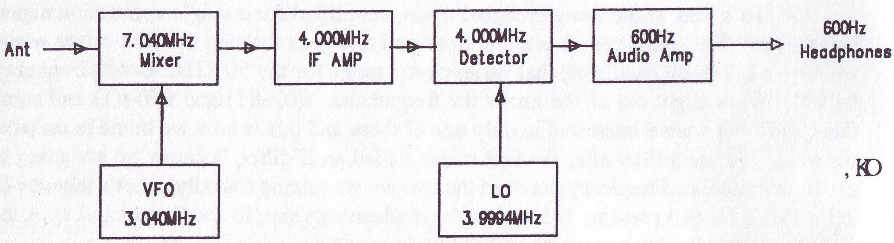

Fig. 3

There are a lot of transceivers out there with setups similar to this, but different frequency combinations and I leave it up to the reader to investigate what you have and what frequency combinations the designer used. The process of mixing two signals (a.k.a. heterodyning) to get another frequency is what makes superhets work. We can play all kinds of games with the VFO frequency and LO frequency and get the same results, but let's save that for another article. OK?

Another thing in the background that makes this work relatively well is the filters that exist in the front-end stage, usually at the antenna, the IF filter just before the IF amplifier stage, and maybe even a builtin audio filter. There all kinds of nasty critters (other frequencies) that mix and also give us 4.000MHz and thus 600Hz out and we will call these critters "birdies". They sing to us and we don't want to hear them.

As another example: if you have a local AM station at 960KHz, then that station

combining with 3.040MHz VFO frequency will yield a signal at 4.000MHz and we will hear a 600Hz tone. Hopefully the RF filters between the antenna and the first mixer (the front-end section of the receiver also called the RF section as we are dealing with RF frequencies) will filter out the AM broadcast station. Ever hear someone else (I hope this isn't a problem with you) say that they are having interference problems from a local broadcast station? Could be this type of problem.

Now I want to show you one other thing. Reach up and turn the tuning dial on "our" receiver. Let's say you move it down 200 cycles. This would mean the VFO frequency would now be 3.039800MHz and we would get 7.040000-3.039800=4.000200MHz out, which most likely will pass through the IF filter and the detector would output 4.000200-3.999400MHz=800Hz, which is what we would expect. The transmitted frequency did not change. We changed the "receiver" frequency by varying the VFO. We now hear in the earphones (speaker) a tone of 800 Hz, i.e. it increased in frequency. This is what we would expect from the above example. If we tune down in frequency and the tone that we hear in the headphones or speaker goes up, this usually means that the VFO is lower in frequency than the received signal and the IF frequency is between the two. We can come up with other frequency combinations that go the other way. There are many design considerations that will determine what we use. Most critical is stability in the VFO, and the lower in frequency it is, the easier to eliminate drift, but we don't want to go too low. Most VFOs in transceivers are between 2 and 5 MHz for this reason. To go higher in VFO frequency and keep stability and eliminate drift increases the difficulty in designing and increases the cost of the components to do this.

Something to consider. The IF filter, usually a lattice of crystals, does not pass frequencies at 4.00000MHz, but a range of frequencies to one side, either the lower or the upper side depending upon whether we want USB or LSB range of frequencies. Think of the IF filter as passing some range of frequencies, say 4.00000 to 4.000600MHz for a 600 Hz filter. We want the LO at 4.00000MHz to receive LSB in our example above. If I set the LO at 4.000600MHz, then I'll receive USB, and here again in order to save space I'll leave it as an exercise for the reader to show how this works. Not difficult at all. This why the tuneup instructions for your kits show how to align the LO in the detector circuit. If I set the LO to 4.000300MHz, I'll hear both sidebands, but only up to 300Hz either side. If you have a superhet receiver and you can tune through a signal and hear the opposite sideband, then you need to go back and recheck the tuning for the LO in the detector circuit after the IF filter.

So now you understand why the tone in your earphones changes when you reach for the tuning dial and tune across the band. The math wasn't all that bad, was it? Those long hours in high school algebra are now starting to pay off. I can show the trigonometry too for the mixer, but let me save that for another time and place.

OK, now we tune back to 600 Hz in the ears, and we are now ready to work this station. Say he/she is calling CQ. We fire up the keyer and get the paddles/key in hand ready to pounce. When the station finished we start with what will hopefully result in a two way QSO. We start sending —— wait just a minute, hold your horses! How in the world do you know you are transmitting on f(0) too? Well, this is where the transmitter alignment comes into play.

If your receiver VFO also controls your transmitter frequency, which is most cases in modern QRP gear, then we need to make sure that it outputs the right frequency too. The transmitter usually looks like Fig. 4.

This diagram assumes a lot, i.e. the VFO frequency is really 3.040MHz and the LO is at 4.000000MHz. Maybe they are and maybe they are not. I will discuss how we align all this up in a later section, but let me give you an exercise.

Dig out your 1995 ARRL Handbook and look in Chapter 17 for Dave Benson's NN1G transceiver. Figure out what part of each circuit corresponds to the diagrams in this article. Figure out the IF frequency for each band and the VFO freqs. Do you see how the differences in frequencies interplay? I knew you could. Now here is how we adjust.

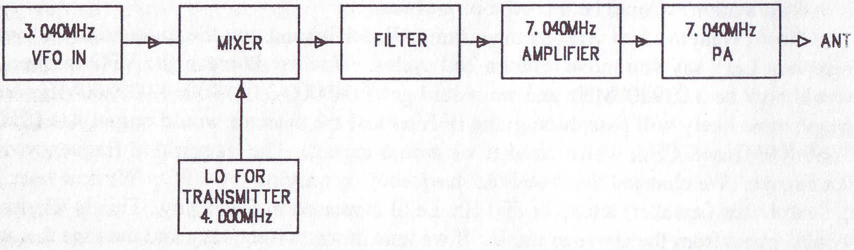

Fig. 4

First of all, we need a combination of three things and let's just start out with two transceivers and one receiver. The two extra rigs we need to calibrate our rig. I'll show later how we can do the same thing with a generator and a frequency counter with the transceiver. For now, one transceiver we will use to transmit on 7.040MHz. We listen for it on both our transceiver on which we are doing the alignment and the other receiver. This latter receiver is used to keep us honest. We cannot trust the alignment on the transmitting rig, even if it costs $3,000, and I mean it. Just because it costs an arm and a leg doesn't mean that it is perfect. This also may be the same reason that we sometimes call someone and they never come back to us even though we know we are on frequency. OK, we transmit on transmitter one, T(1) on frequency f(0) and we listen on the receiver, R. We now know where the signal source is and when we transmit with our transceiver that we are aligning we will know if we are in sync, i.e. transmitting on the same frequency.

We now take our transceiver and tune in f(0) until we tune in and hear the frequency that we like to hear. This varies from person to person (remember this and it is important). OK, key down. How do we know where we are transmitting? We listen in the receiver. We may have to tune around to see where we are, but hopefully we are close. We then adjust the LO in the TRANSMITTER of our transceiver until we get 7.040MHz out. Most rigs will have a variable trimmer cap on a crystal oscillator circuit that will allow us to adjust the resonant frequency near where we want to be. We will know where this is by listening to both our signal and the signal from the other transmitter and getting them on the same frequency. Don't move the dial setting on the original transmitter or on the transceiver that we are aligning. You don't want to have the key down on any transmitter for very long. Do short bursts between the two. When you are sure that you are transmitting on the same frequency as the reference transmitter when you are receiving the signal at the note that you like, then you are done. Move the transmitters around and try this on other frequencies to make sure your alignment is correct. OH, you are doing this with dummy loads on both transmitters? I knew you were.

You can do this with a steady signal generator instead of a transceiver and you can use a digital frequency counter instead of another receiver, but you have to be careful not to overload the counter and of course, we are working all transmissions into a dummy load from the start. Do not do this into an antenna. The rest of the world will not appreciate it at all.

With the counter, you measure the output of the signal source and then the output of the transmitter in the transceiver when you are receiving the signal source in your receiver at the desired comfortable tone you are used to.

Now, do you know why we do this in the above manner? Well, you can't trust another transceiver (unless you set it up) to have its receiver tuned to the exact frequency that it is transmitting on. Have you ever had this happen? You hear someone transmitting and you give them a call and they don't come back to you. There may be several reasons for this: 1. you are too weak, 2. they hear another stronger station, and 3. they just might not be listening on their transmit frequency. They just might have RIT on and have forgotten about it. Sometimes the rigs come from the factory misaligned. Yes, I know it's just too hard to believe, isn't it??? When is the last time you checked out a rig to see if it is on track? You might be surprised.

After reading this and if you have the time and equipment to do so, test this article against your rig and see if it is aligned properly. You will need and will have to understand the schematics and the operation of the rig you are testing.

Good luck and I hope this article has furthered your knowledge of transceivers, receivers, and communications in general.

dit dit 72, Chuck Adams K5FO CP-60 adams@sgi.com

Directional Power Meter

By Jim Pepper, W6QIF
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Orinda, CA 94563

In the days when the only method of generating RF power was the vacuum tube and Ham transmitters were best if they resembled AM broadcast stations, the concern for standing waves and reflected power was of little concern on the HF bands. Antennas were primarily of four types, a half wave either centered or end fed with open wire (600 ohm) line, an off center fed with a single wire (later called a Windom antenna), and an end fed called a Marconi type of various lengths. Co-ax had to wait till after WWII to be used.

All of these antenna types required an antenna tuner. The common method to determine whether the antenna was taking power was through the use of an RF ammeter, a neon lamp or a pilot lamp in series with the feeder line or lines. Losses in the feed line as a result of a mismatch were so small that they were ignored.

In the late sixties and seventies the use of transistors as RF power generators were starting to be found in amateur equipment. Their low output impedance allowed broad banding with out the necessity of tuning the output stage of the transmitter. However their efficiency depended on having the load match the designed output impedance of the RF stage. Transistors were not as forgiving as vacuum tubes to a mismatch and therefore required more attention to the use of an antenna tuner. To help in obtaining a good match, the directional power meter or SWR meter came into use. The sole purpose of the tuner is to provide an impedance match at the end of the feeder line to best match the transmitter output impedance. One can still have a high SWR on the transmission line but the power will still be radiated. The main problem is in the power loss in the transmission line. The loss is affected by three main factors, the length of line, the type of feeder line and the frequency of operation. For ham bands from 160 to 20 meters, the loss due to a high SWR is negligible if the transmission line is not excessively long. For an end fed Marconi there is no transmission line and therefore no loss, yet a tuner is required.

Mismatch takes place in two areas, the point where the feeder connects to the antenna and where the feeder connects to the transmitter. Through the use of a tuner we can

obtain a good match to the transmitter but the mismatch at the antenna depends on a number of things.

First is the impedance of the transmission i.e. 50 ohm co-ax or 600 open wire line. Secondly, the type of antenna. The center of half wave doublet antenna has what is called the radiation resistance that is around 70 ohms. This resistance depends on the height above ground and ground conductivity. For an end feed, the resistance and reactance can either be high or low depending on its length. If there is a mismatch, a cetain amount of the radiated power will be sent back down the line. If this reflected power sees a match at the transmitter end, it will be re-radiated back up the line where part will be radiated and part will be again reflected until reduced by the loss in the line.

To put it a few simple words, if you use a tuner that matches the feed line impedance to the transmitter on the lower frequency bands, there is no need to match the transmission line to the antenna because almost all of the power will be radiated. In addition, pruning the length of antenna or feed line is a waste of time. Remember, all of this is based on using a matching tuner otherwise all bets are off. Of coarse you can use a center fed doublet with 50 or 75 ohm co-ax and not require a tuner because the missmatch would probably never be greater than 2 to 1 as long as the transmitter can handle this amount. But in addition, the matching device also provides harmonic filtering when used which makes its use advisable.

Matching the Feed Line to the Transmitter

The tuner must be so designed to cancel out the reactive component of impedance that appears on the end of the transmission line for either a balanced or unbalanced line. Since most of the QRP work is done with an unbalanced line, this simplifies the design. This is where the directional power meter comes into play. Through its use, the tuner is adjusted to give minimum reflective power vs maximum forward power, thus providing the correct match to the transmitter.

Directional Power Meter

Figure 1 shows the schematic for a directional power meter that can be used for unbalanced or balanced lines with a tuner. The power meter is placed between the transmitter and the tuner. The circuit in this case uses a bar graph presentation rather than two meters for the forward and reverse power. The space required is much less than for two meters and the cost is less.

Since it is normally used only when initially tuning up, the power can be turned off when no longer required. A 9 volt battery works very well or you can derive power from your transceiver.

The current required when in standby is approximately 15mA, and with 10 segments on, it is about 50mA. The LED current is controlled by the resistor between pins 2 and 7. It might be a good idea to put an LED in the battery circuit to tell you when the power is on or off.

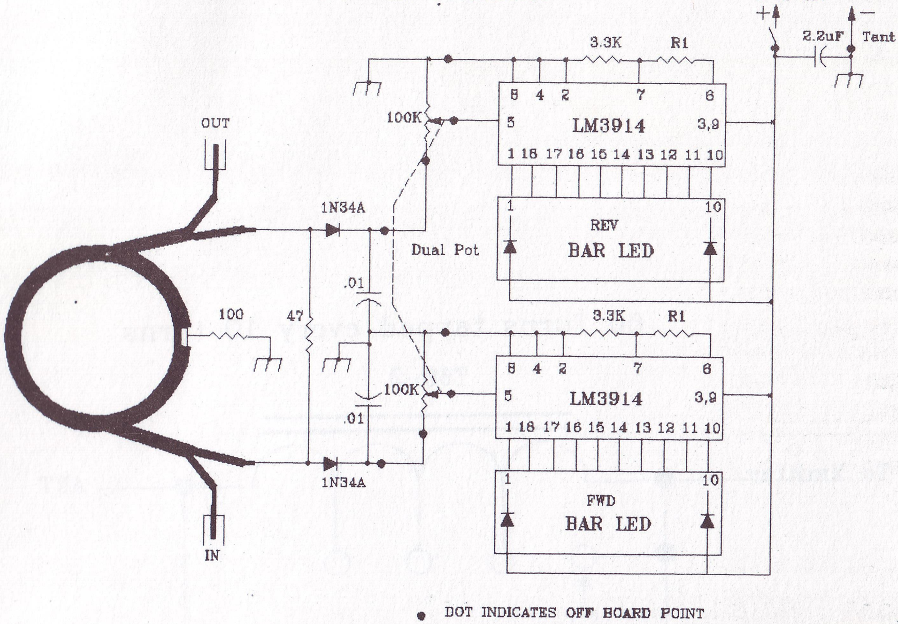
An LM3914 is used as a voltage to LED level indicator. The LM3914's sensitivity can be controlled by a resistor between pins 6 and 7. I found a value of 82K provides enough sensitivity for 2 watts or more. Increasing the value to 100k should prove satisfactory for lower powers.

The dual potentiometer is used to set the forward level to ten segments on the display. It will have to be readjusted as you go through the tuning procedure. The end result is to have a maximum on forward and a minimum on reverse. The two may not coincide but they will be close enough to indicate a matched condition.

I found, rather than using coils or coax for the line transformer, that "ZIP cord" used for appliances could be used with very good results. This would not be true in the VHF region but is perfectly adequate for the 160 to 20 meter bands. I compared the results

with a SWAN directional power meter and the comparison was quite favorable. One leg of the ZIP cord goes from input to output and the other goes to the metering circuit. This

DIRECTIONAL POWER SCHEMATIC



BASIC CIRCUIT

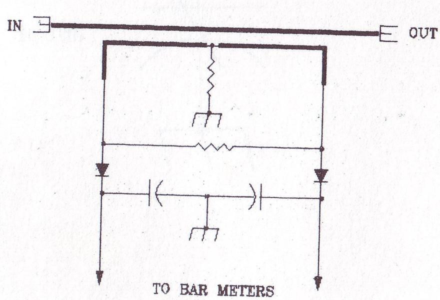


Fig. 1

leg is tapped at the center and connected to ground through a 100 ohm resistor. I wound the ZIP cord in the form of a circle to occupy less space since the size I used was ten inches long. If you only want it for 40 and 30 meters, the length could be reduced if you have sufficient sensitivity to give full scale on the bar graph.

Figure 2 shows a simple tuner that I use to tune my 250 end fed long wire for 40 and 80 meter operation. The capacitor can be switched from the input side to the output side to accomodate various lengths of antennas. For co-ax operation, the coil should be shorted out. For short endfed antennas, either a ground or counterpoise must be used.

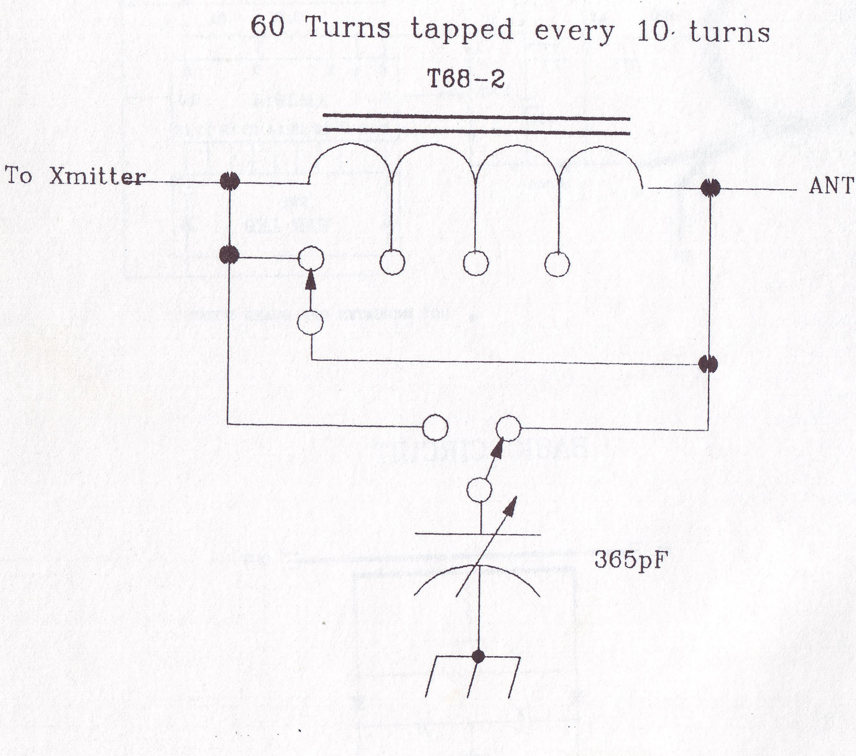
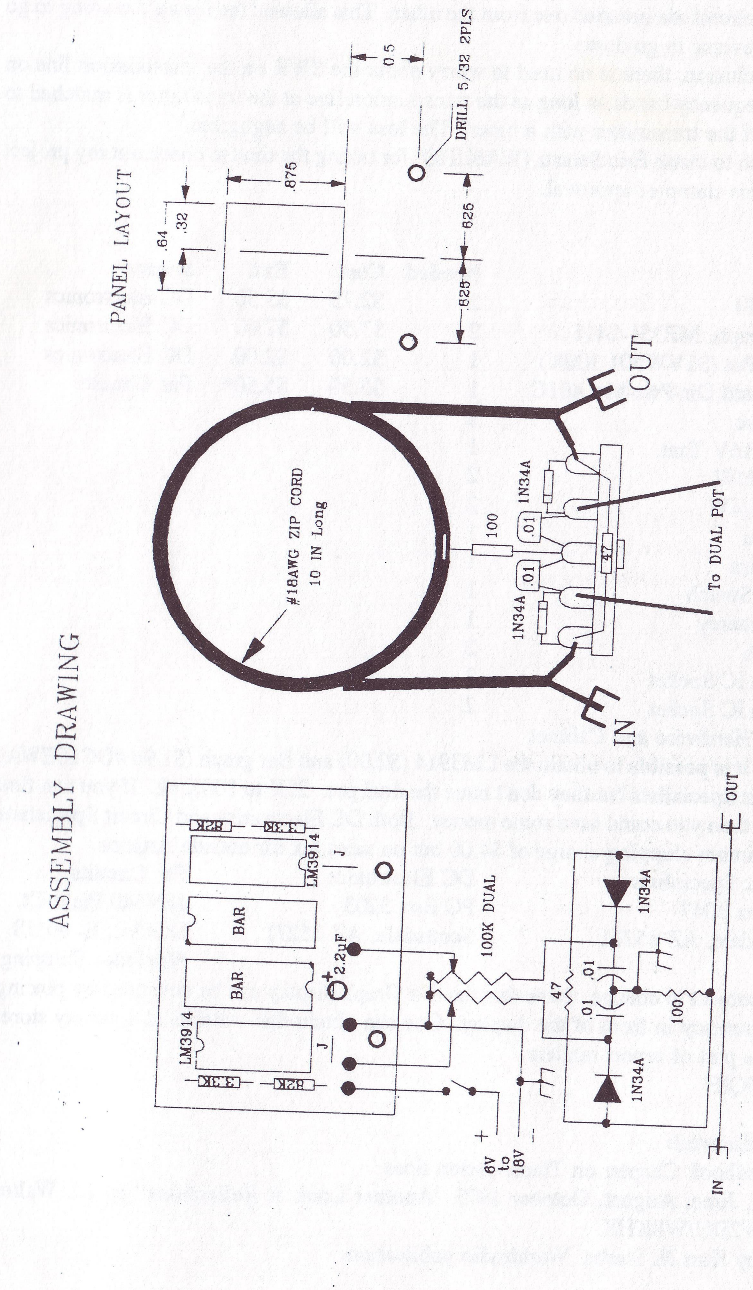


Fig. 2



ASSEMBLY DRAWING
PANEL LAYOUT
.64
.32
.875
0.5
DRILL 5/32 2PLS
.625
.625
#18AWG ZIP CORD
10 IN Long
100
.01
.01
47
1N34A
1N34A
To DUAL POT
OUT
IN
LM3914
BAR
BAR
LM3914
J
J
3.3K
82K
82K
3.3K
2.2uF
100K DUAL
6V
to
18V
+
-
1N34A
1N34A
47
.01
.01
100
OUT
IN

Fig. 3

Figure 3 shows the parts layout for the pc board that can be obtained from FAR Circuits. See parts list for cost and address.

I used 20 pin sockets to mount the Bar graphs and 18 pin sockets for the LM3914's. The LM3914 has a small bevel edge that indicates pin number 1. Note that the forward and reverse circuit are inverted one from the other. This allowed the forward reading to go up and the reverse to go down.

In Conclusion, there is no need to worry about the SWR on the transmission line on the lower frequency bands as long as the transmission line at the transmitter is matched to the output of the transmitter with a tuner. The loss will be negligible.

I also wish to thank Eric Swartz (WA6HHQ) for taking the time to check out my project and giving his stamp of approval.

Parts List:

	Part	Needed	Cost	Ext.	Source
1.	LM3914	2	$2.75	$5.50	DC Electronics
2.	Bar Graph, ME351-2411	2	$3.50	$7.00	DC Electronics
3.	Dual Pot (31VW501 100K)	1	$2.00	$2.00	DC Electronics
4.	PC Board Dir-Pwr-Mtr 401C	1	$5.50	$5.50*	Far Circuits
5.	.01 Disc	2			
6.	2.2uF/16V Tant.	1			
7.	82K 1/4W	2			
8.	3.3K 1/4W	2			
9.	47 ohm	1			
10.	100 ohm	1			
11.	SPST Switch	1			
12.	9V Batterey	1			
13.	1N34A	2			
14.	20 Pin IC Socket	2			
15.	18 Pin IC Socket	2			
	Misc. Hardware and Cabinet				

Note: it is possible to obtain the LM3914 ($2.00) and Bar graph ($1.96 #DC10EWA) from Circuit Specialists but they don't have the dual pot. 25K to 100K ok. If you can find this locally then you could save some money. Both DC Electronics and Circuit Specialists have a minimum shipping charge of $4.00 but no sales tax for outside Arizona.

Circuit Specialists	DC Electronics	Far Circuits
PO Box 3047	PO Box 3203	18N640 Field Ct.
Scottsdale, AZ 85271	Scottsdale, AZ 85271	Dundee, IL 60118
		*Includes Shipping

Prices are subject to change. Note that the Bar Graph display can be enhanced by placing a red transparency in front of the display. One can obtain this material at a variety store. It is used as part of report binders.

72, Jim W6QIF

Reading Material:

ARRL Handbook Chapter on Transmission lines

QST April, June, August, October 1973 "Another Look at Reflections" by M. Walter Maxwell W2DU/W8KHK

Aerials II by Kurt N. Sterba Worldradio publication.

My NorCal Sierra Experience

By Bill Shanney, KJ6GR
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I was very happy to receive my Sierra QRP Transceiver kit during the long Thanksgiving weekend. I wasted no time getting started, the main board was completed over the weekend and the 40 meter plug-in band module was finished during the following week. The rig put out 2 watts on 40 and I received many complements on the keying quality. The 80, 30, and 20 meter band modules were completed in one more week and I was disappointed with the results. The output power/band measured 2.5W/80M, 2W/40M, 1W/30M and 0.5W/20M.

I went through the signal tracing routines described in the "Troubleshooting" section of the Owners's Manual and found an inconsistency between my power reading and the output voltage which I happily discovered was due to a bad coax cable. A new cable brought the power on 20 up to just over 1 watt. I had a telephone conversation with Wayne, N6KR, read his article in the December QRPp and was ready to start modifications. The following is a list of my changes and their outcomes.

1. I changed C69 to 39pF, no change in output power noticed.

2. I rewound T2 with an 18T primary and a 5T secondary, the power output dropped on the lower bands. I changed the secondary to the original 2T and the output power was up a little on all bands. I eventually tried changing the primary to 15T but saw very little change.

3. I changed R15 to 100 ohms and the power went up a bit on all bands.

4. I noticed that about 25% of the signal was being lost in the low pass filter on the higher bands. I changed C47, 48, and 49 to silver mica types as suggested and the power came up considerably. I changed the caps on the 40, 30 and 20 meter modules.

5. I replaced the output PA transistor with a MRF-237 and picked up some more output on 30 and 20 meters.

The low pass filter capacitor change and the R15 change had the biggest effect and I think would have satisfied my desires if I tried them first. I now have a very respectable power output/band of 3W/80M, 3W/40M, 2W/30M and 2W/20M with the drive adjustment backed off to slightly less than 90%.

I really enjoyed building and modifying my Sierra. Wayne, N6KR and the NorCal Club are to commended for an outstanding project. While waiting for the kit to come I built a W7EL QRP SWR meter, an A&A CMOS keyer, several antenna tuners and a multiband offset fed dipole which, together with the Sierra, fit in a plastic tool box to make a fine portable setup.72, Bill, KJ6GR

OPTIMIZED SIERRA OUTPUT-FILTER VALUES

By Dave Meacham, W6EMD
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Want to tweak your Sierra output circuit to the max? Here's how! Simply use the nearest standard capacitor values and inductor data shown below. Note that the 20-meter values do NOT need to be changed.

NORCAL SIERRA OUTPUT-FILTER VALUES

FILTER COMPONENTS THAT EQUAL 50 OHMS REACTANCE AT HIGH END OF RANGE

High End		L5&L6	C47	C48	C49	Nearest Std. Cap. Values
1.95MHz	4.08uH	1633pF	3266pF	1633pF	1600, 3300 (3300 Stock)
3.65	2.18	873	1745	873	910, 1800 (1800 Stock)
7.15	1.11	445	891	445	430, 910
10.15	0.784	314	628	314	300, 620
14.15	0.563	225	450	225	220, 470 (Stock OK)
18.15	0.439	176	351	176	180, 360
21.15	0.376	151	301	151	150, 300 (150 Stock)
24.95	0.319	128	255	128	120, 250
28.15	0.283	113	226	113	120, 220

NEAREST INDUCTOR VALUES

1.95MHz (4.08uH)	4.10uH, 32T. on T37-2 core
3.65MHz (2.18uH)	2.19uH, 27T. on T37-6 core
7.15MHz (1.11uH)	1.08uH, 19T. on T37-6 core
10.15MHz (0.784uH)	0.784uH, 14T. on T37-2 core
14.15MHz (0.563uH)	0.576uH, 12T. on T37-2 core (Stock Sierra OK)
18.15MHz (0.439uH)	0.432uH, 12T. on T37-6 core (Stock Sierra OK)
21.15MHz (0.376uH)	0.363uH, 11T. on T37-6 core (Stock Sierra OK)
24.95MHz (0.319uH)	0.324uH, 9T. on T37-2 core
28.15MHz (0.283uH)	0.275uH, 8T. on T30-2 core

If the stock Sierra caps mentioned above are within 5%, then only the following additional caps are needed:
2-1600pF, 3-910pF, 2-430pF, 3-300pF, 1-620pF, 2-180pF, 1-360pF, 4-120pF, 1-250pF, 1-220pF.
Cores needed: 2-T30-2. (Use 12 and 10 meter T37-6 cores on 80 and 40)
Note: Silver-mica caps come in the widest selection of values. Polystyrene caps are next. Monolithic caps have more loss but will work.
Have fun! 72, Dave, W6EMD

VARIABLE-POWER CAVEAT

By Dave Meacham, W6EMD
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On many QRP rigs the output power is adjustable. Each rig, however, is usually designed for a SPECIFIC power level. There are good reasons for this, as I will explain.

The function of the output filter in a QRP rig is to attenuate (reduce) harmonics because the PA (power amplifier) output is not a pure sine wave (in fact, many PA's produce output very rich in harmonics). Output filters are designed for specific terminations (source and load resistances), usually 50 Ohms. If the load (antenna) or source (PA) does not present 50 Ohms to the filter the result is more harmonic output and possible spurious emmissions from the PA. I have personally confirmed such results by observations using my spectrum analyzer.

I'm sure most QRP operators are aware of the importance of having a good 50-Ohm

match at the antenna terminal of the rig (the filter output). Not as well known is the need for a 50-Ohm match at the INPUT to the filter.

Providing the proper load for the transistor PA gets complicated at VHF and above. For HF operation, though, we are usually safe in assuming that the proper resistive component of the load should approximate the collector-voltage squared, divided by two times the power. So for 14 Volts and 2 Watts, RL=196/4=49 Ohms. With a 50-Ohm load on the output of the filter, and 50 Ohms presented to the PA, everything should be fine at 2 Watts.

What happens if you "turn up the wick" to 4 Watts? Well, now the PA wants to see 196/8=24.5 Ohms. Since the filter is still presenting a nice 50-Ohm load for the PA you have a 2:1 mismatch! The same situation would occur if you turned the power DOWN to one Watt (196/2=98 Ohms, again 2:1). Either way the result is a bad load for the PA and a bad source for the filter. Solutions for this problem (at a specific power level) include using a transformer or a matching-type of filter.

Component values (active and passive) vary quite a bit. Therefore, performance varies from rig-to-rig. Designers recognize this and sometimes include a control to vary the power (drive control, etc.).

If your radio has such an adjustment, think of it as a way to compensate for transmitter-component values that are not on the money. Then use it to set the output power to the design value.

My admonition is: If your QRP rig is a 2-Watt radio, run it at 2 Watts! 72, Dave, W6EMD

Oscillator Designs With Varicaps

by Jim Pepper, W6QIF
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Orinda, CA 94563

To my knowledge there has been very little information in amateur publications as to how to calculate the controlling frequency elements for the standard oscillators used in home brew amateur equipment. The normal approach is to use the cook book method, to use what other people have used as their design criteria. I decided to take a little time and develop some of the equations for the Hartley, Colpitts, and Clapp oscillators in conjunction with the use of Varicaps as tuning elements. I was particularly interested in the Hartley circuit but decided to do it for all three to see what the comparison was especially when tuned by a Varicap.

The Varicap has been used quite often but on a sort of hit or miss basis to get the right value. There are a number of things about the Varicap or some times called a Varactor diode that should be considered.

1. They are temperature sensitive
2. The capacitance variation as a function of the applied voltage is very non linear. The greatest change takes place at the low voltage end.
3. They come in various min/max values but the minimum does not approach that of a mechanical capacitor.
4. As the temperature increases, the capacitance increases causing the frequency to go down.
5. It is not wise to use Varicaps as the only source of controlling capacitance for frequency selection because of their temperature problem.
6. For proper operation, a positive voltage is applied to the cathode rather than the anode.

7. They do have some advantages: they are small, they are inexpensive, and because their capacitance is changed by varying an applied voltage to the device, precision tuning can be achieved using a ten turn potentiometer as the voltage control. With a mechanical tuning capacitor with a reduction gear ratio of 8:1, the dial only rotates 4 turns for 180 degrees of the capacitor tuning.

8. Some of the Varicap ranges available are:

MV2109 33pF @ 4V rev bias
MV2115 100pf @ 4V rev bias
MVA109 450pF @ 1V rev bias
NTE618 440pF @ 1V rev bias

So, how can these Varicaps be used? They can be used as band spreading capacitors allowing the tuning of a small frequency range such as covering just the ham band. For example 7.0 to 7.3 MHz. In the three examples I have shown how to calculate the required components to give the required ranges. One must understand that these equations give you a starting point since there are other variables that come into play such as circuit capacitance and component tolerances.

In my examples, except for the Colpitts circuit, in order to keep it simple, I didn't bring in the minimum capacitance of the Varicap which will modify the inductance required at the upper frequency. One can add about 10% to the chosen value for C2 pF, the fixed capacitor in the frequency determining circuit. I also made the assumption that C3 and C4 are equal in value which is the common case. In the case of the Colpitts, I also assumed a value for the capacitor designated C5 making it equal to .5 C3.

The first thing that must be chosen is the value for C2. It should be as large as possible to give a high C/L ratio. On the other hand, if C2 is too large, the Varicap may not be able to add enough capacitance to it to provide the additional range.
In all cases the FET was an MPF102 operating with 5 volts on the drain. (For those unfamiliar with an FET, the drain is like the plate in a vacuum tube , the source is like the cathode and the gate is like the grid.)

The Hartley Circuit

The Hartley uses the least number of components of the three. It does require a tap be made on the coil but its position is not too critical to make it oscillate. More about this later. It also required the least amount of capacitance variation from the Varicap to achieve the same tuning range. The object is to determine the value of C1 to give the range desired for a given range for the Varicap diode capacitance. It must be noted that the required additional capacitance CA required to tune the lower frequency edge must be less than or equal to the maximum value of the Varicap. The object is to use the least amount of Varicap change to achieve the desired range. The value of the coil for the Hartley is considered to be made up of three inductances L1, L2 and 2M the mutual inductance between L1 and L2.

When solving for the value L for the actual coil to be used, the value developed from the equation must be reduced by the value for the mutual inductance. I have chosen this to be 10% of the calculated value of the coil.

The procedure to follow is:

1. Chose a value for C2, the fixed value capacitor for the tuning circuit.

2. Next, calculate the inductance necessary to tune this circuit to the upper frequency desired.

3. From this value of L, calculate the capacitance necessary to tune the lower band edge desired.

4. Subtract the original value of C2 from this number. This gives the required additional capacitance to tune the lower edge. I called this capacitance "Ca".

5. Chose a Varicap capacitance type that is greater than this value. I usually subtract out 10% from the maximum value to reduce the non-linear portion of the Varicap.

6. Solve for the coupling capacitance C1 to give the required range.

7. Solve for the value of the coil L (Note: a good source for determining the number of turns required to achieve the required inductance can be found in Vol 1, Number 3, Dec 1993 of the QRPp journal, page 42, by WA8MCQ

You will note in all of the circuits I have included a fixed resistor in the upper and lower portion of the ten turn tuning pot. The lower one prevents the reverse voltage from going to zero where the Varicap is very non-linear. This voltage should be about 1 volt or greater. The upper resistor limits the upper frequency. These resistors could be made variable to set the upper and lower frequency points more precise. R3 is used to further linearize the capacitance change. A typical value is about .5 of the ten turn pot value. Such a technique can make a linear pot into an audio taper pot as well.

The Colpitts and Clapp Oscillators

These two oscillators are basically the same relying on C3 and C4 for the feedback. The procedure for calculating the component values are the same as for the Hartley. The Colpitts requires the most capacitance for a given tuning range. The Hartley the least.

Temperature Compensation when using Varicaps

You will recall in the early part of this article I mentioned that I would talk about the tap on the Hartley. During my experimentation with the Hartley, I accidentally found that changing the location on the tap would change the tempco of the oscillator. I first noticed this when I was experiment with the oscillator operating on 14 MHz They're a number of sources that would case the frequency to change as a function of temperature.

1. The Varicap. As the temperature goes up the capacitance increases causing the frequency to go lower
2. The MPF102 likewise does the same thing when heated
3. The polystyrene capacitors reduce capacitance when heated
4. Silver Micas can go either way
5. The toroid didn't change very much with temperature T50-6

In my test circuit, I used polystyrene capacitors as the major frequency determining device. The Varicap used was either a MV2115 or a NTE618. All tests were made with the Varicap at full capacitance giving worst case condition.

Initially, if I found the frequency went down when the temperature went down the tap was too high. If they go the opposite direction, the tap is too low. (Normally the tap is set at about 1/3 the total number of turns on the coil.) On the 80 meter circuit, I reduced the change to essentially zero. The change as a function of the tap position is more noticeable as you go up in frequency to the 40 and 20 meter bands. I am not quite sure what is happening but I have a theory that it might be the result of heating the poly capacitor because of increased RF currents flowing in it as the coil tap is raised. The literature on oscillators say to use the lowest tap that produces oscillation for improved stability. In this case, improved stability is found by increasing the tap position. The net result is to cancel the other sources of drift due to temperature.

Since I didn't have a temperature controlled oven for the experiment, I took a reading before I went to bed and then opened the window of the radio room. (I can't call it a radio shack since it is a bedroom once used by one of my sons.) I usually observed at least a ten degree change the next morning. A home brew frequency counter was used for reading the changes. If you have a commercial receiver with counter, it could be used.

In the case of the Colpitts and Clapp, I didn't find this kind of change as a result of increasing C3 to increase the feedback coupling although this capacitor is already com-

pensating for temperature drift. In my circuit in the Deluxe QRP Station, QRPp journal Vol II #2, June 1993 I used a Clapp circuit that has a temperature drift of about 75 Hz per Degree F. I used polystyrene capacitors, 470 pF for C3 and C4 and 270 pF for C1 and C2. The Varicap was a MV2115.

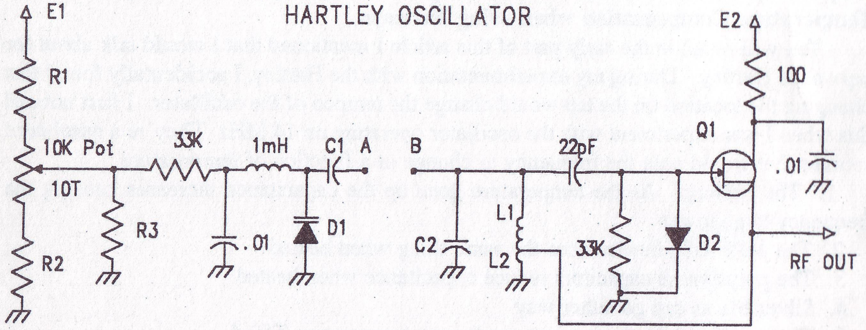
At 14 MHz I was satisfied with approximately 100 Hz/F using an NTE618 giving a tuning range of 2 MHz. With further adjustments, I believe I can reduce this even further. The circuit I am going to use this oscillator in will divide it by 2 thus reducing the drift even more.

Conclusion

Perhaps this discovery will lead others to try out this method of compensation. In the past I have tried other methods but never with good results. The Hartley appears to be the best circuit for this to work and, in addition, it uses the least number of components. You could be lucky with silver micas. Place a soldering iron next to the capacitor and see if the frequency goes up. If does, it could give similar compensation.

I wish to thank John Dorsey for perusing my article for errors or additions. John Dorsey's son is an amateur.

Note: In using Calculations, use the closest RETMA value for C1.



$$F = \frac{1}{6.28\sqrt{(L1+L2+2M)C2}} \;.\; = L_t$$

$$M = K\sqrt{L1 \times L2}$$

$$\text{OR: } L1 + L2 + 2M + \frac{1}{39.4(F \times F)C2} . = L_t$$

Where F is the upper frequency desired. Choose a value for C2 and solve for L_t .
NEXT: Choose the lower Frequency desired F and solve for a new C2.

$$C2_L = \frac{1}{39.4(F \times F)L_t} .$$

THEN: $C2_L$ - C2 = CA. If A is connected to B, then C2 is in parallel with the series combination of C1 and the Varicap capacitance of D1. The capacitance at $A = \frac{C1Cd1}{C1 + Cd1} = CA$

NOTE: CA must be less than the maximum capacitance of the Varicap in order that the solution be valid. Choose the maximum value for Cd1 (see text) and solve for C1. Then,

L(Coil) = L_t - 2M Where 2M typically equals about .1L_t .

EXAMPLE:
Desired Frequency Range 7.0 - 7.3 MHz.
C2 = 270pF   Cd1 = 10 to 80pF
Solve for Lt for 7.3MHz

$$Lt = \frac{1}{39.4(7.3 \times 7.3)270} = L1 + L2 + 2M = 1.6uH$$

Solve for C2 to give 7.0MHz: $$C2_L = \frac{1}{39.4(7.0 \times 7.0)1.6 \times 10^6} = 324\ pF$$

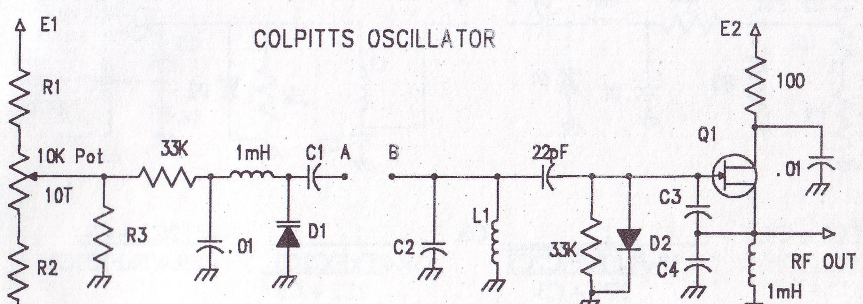
THEN: $C2_L - C2 = CA = 324 - 270 = 54pF$

Solve for C1: $$CA = \frac{C1 \times Cd1}{C1 + Cd1} = \frac{C1 \times 80}{C1 + 80} = 54$$

$$C1(80 - 54) = 80 \times 54$$

$$C1 = 167pF$$

and Lcoil + Lt - 2M where 2M = .1Lt   Lcoil = 1.6 -.16 = 1.44uH



If C3 = C4 and C5 = .5C3

$$F = \frac{1}{6.28\sqrt{(C2 + .25C3)L1}} \quad \text{or} \quad L1 = \frac{1}{39.4F \times F(C2 + .25C3)}$$

Choose a value for C2 and C3 (see text) and solve for L1 where F equals the upper frequency desired.

NEXT: Solve for $C2_L$ where F_L is the lower frequency desired.

$$C2_L = \frac{1}{39.4 \times F \times F \times L1} - .25C3$$

Let $CA = C2_L - C2$ If A is connected to B, then C2 is in parallel with the series combination of C1 and the Varicap capacitance of D1. The capacitance at

$$A = \frac{C1Cd1}{C1 + Cd1} \quad \text{or} \quad C1 = \frac{CACd1}{CA + Cd1}$$

Note: CA must be less than the maximum capacitance of the Varicap in order that the solution be valid. Choose the maximum value of Cd1 (see text) and solve for C1.

Example: Desired Range 7.0 to 7.3MHz.

C2 = 270 + 40 = 310, C3 = C4 = 470, C5 = .25C3 = .25 x 470 = 117 Cd1 = 40 to 400

Solve for L at 7.3MHz:

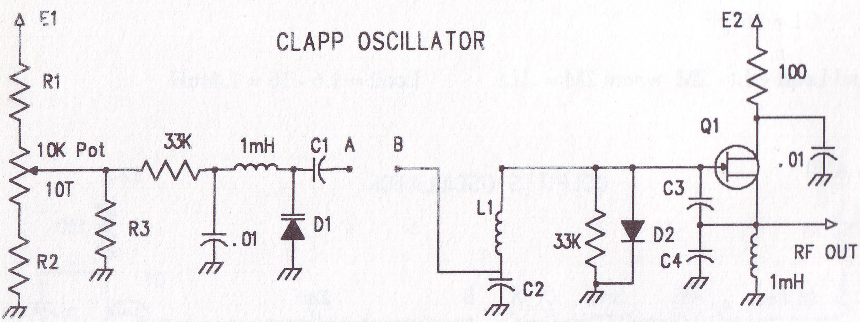
$$L = \frac{1}{39.4 \times 7.3 \times 7.3 \times (295 + 235)} = 0.8uH$$

Solve for C2 at 7.0MHz:

$$C2_L = \frac{1}{39.4 \times 7.0 \times 7.0 \times 0.8 \times 106} - 0.25 \times 470 \times 10^{-12}.$$

$$= 647 \times 10^{-12} - 117 \times 10^{-12} = 529pF$$

CA = 529 - 270 = 259pF $\quad C1 = \frac{CA \times Cd1}{Cd1 - CA} = \frac{259 \times 400}{400 - 259} = 735pF$



$$\text{If } C3 = C4,\ F = \frac{1}{6.28\sqrt{\frac{Lt(FxF)C2C3}{2C2 + C3}}} \text{ OR } \frac{1}{\frac{39.4(FxF)C2C3}{2C2 + C3}} = \frac{2C2 + C3.}{39.4(FxF)C2C3}$$

Choose a value for C2 and C3 (see text) and solve for L where F equals the upper frequency desired.

NEXT: Solve $C2_L$ where F_L is the lower frequency desired.

$$C2_L = \frac{C3}{(39.4LxFxFxC3) - 2}.$$

Let $C2_L$ -C2 = CA

If A is connected to B, then C2 is in parallel with the series combination of "C1 and the Varicap capacitance of D1. The capacitance at

$$A = \frac{C1Cd1}{C1 + Cd1} \quad \text{or } C1 = \frac{CACd1}{CA + Cd1}$$

Choose the hightest capacitance of Cd1 (see text) and solve for C1

Example: Desired range 7.0 to 7.3MHz.

$C2 = 270pF \quad C3 = C4 = 470pF \quad Cd1 = 10 \text{ to } 80pF$

Solve for L for 7.3MHz

$$L = \frac{2x270x10\text{-}12 + 470x10\text{-}12}{(39.4x270x10^{-12})(470x10^{-12})(7.3x7.3x10^{+12})} = \frac{1010x10\text{-}12}{266.4x10^{-7}} = 3.79x10\text{-}6 \text{ or } 3.79 \text{ uH}$$

$$C2_L = \frac{470x10\text{-}12}{(39.4x3.79x10^{-6})(7.0x7.0x10^{+12})(470x10^{-12}) - 2} = \frac{470}{3.44 - 2} = 326pF$$

Then: $CA = 326 - 270 = 56pF$

Solve for C1:

$$CA = \frac{C1 \times Cd1}{C1 + Cd1} \qquad 56 = \frac{C1 \times 80}{C1 + 80} \qquad \text{Or: } C1980 - 56 = 80x56 \quad C1 = 196pF$$

An Integrated Keyer and Displayless Frequency Counter for QRP Transceiver

By Wayne Burdick, N6KR
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I put a 10-turn pot into my NorCal 40A to increase the VFO tuning resolution, then realized that I'd need a frequency counter. Since I also wanted an internal keyer with a message buffer, I decided to follow through with a project I'd been threatening to do for a whole year: a microprocessor-based keyer and frequency counter.

In order to keep the size, cost, and current drain down, I gave up trying to use a display of any kind. Instead, the counter reports your operating frequecy using Morse code. The frequency report is sent as audio, directly to the A.F. amplifier, so the rig need not be keyed. This works very well for occasionally checking your operating frequency down to the nearest kHz. One side benefit is that you can easily read the frequency in the dark or while operating mobile. (Or both!)

History

The first time this displayless-counter idea struck me was when Doug Hendricks and I were driving to the Zuni-loop field day site in 1994. Doug thought it was a great idea, and I swore him to secrecy, which he honored. I didn't find time to work on it until just before Field Day 1995; I got it working just an hour before leaving for the Zuni-loop again. Fred Turpin, K6MDG, really put it to the test at FD.

Philosophy

I didn't intend this unit to be a replacement for the do-everything home-station keyer. In fact, you can still plug in a keyer or manual key into the existing key jack on the rig. What I wanted was an internal QRP keyer/counter module for field operation, where you don't necessarily need the big contest keyer with a dozen buttons that outweighs the QRP transceiver itself.

Description

The keyer/counter unit is based on a PIC 16C84 microprocessor. All parts and controls are mounted on a PCB that's only 0.8" tall and 2.5" wide, so it will fit on the front or rear panel of the NorCal 40 or 40A, Sierra, 40-40, or just about any other rig.

Because of the small size, there are only three controls: a speed pot, a message play/record button, and a frequency read/search button. A short press of the message button

plays a stored CW message; a long press records a new message. A short press of the frequency button reports your current frequency, while a long press enters a search mode, in which you use the keyer paddle to send the unit a frequency to search for. Pressing both buttons at once puts you into command mode. (Given my recent rants about ergonomics, I won't tell you all the complicated things you can do in this mode!)

Keyer Details

The keyer is Iambic, with user-programmable keying behaviour. There's quite a debate about which Iambic mode is best, so I included variations of both A and B. The non-volatile message buffer holds up to 48 characters, and messages are sent with automatic character and word spacing. There are several fixed keying weights selectable in command mode, as well as optional side-tone. Finally, there is a TUNE command for doing antenna tuner and transmitter tune-up.

Counter Details

The counter function is performed with the help of an inexpensive 74HCT4020 divider IC. This IC divides the VFO frequency by 256. The PIC counts the output of the divider for 256ms, then adds or subtracts this from a programmable offset. The VFO can be up to 8MHz, and by setting the offset to 0, the unit can even work with direct conversion rigs.

In the case of the NC40 or 40A, the VFO runs at 2085 kHz when the operating frequency is 7000 kHz. To get the proper 3-digit frequency reading, the offset is programmed as "A915," or "add 915 to the VFO." So if the PIC counts the VFO as 085 kHz, it adds 915, which ends up as a report of "000."

The keyer/counter unit can store up to four VFO offsets, so you can use it with multiband rigs that have up to four different band edges. For example, with the Sierra, you could use the "M0" and "M1" jumpers on the band module as inputs to the keyer/counter. When you plug in the 80-meter module, it would select an offset corresponding to a band edge of "500" instead of "000".

In search mode, you use the keyer paddle to send a 3-digit frequency to the counter, then turn the VFO knob until you hear it send a special "frequency found" tone.

Noise? (Not!)

Microprocessors put out a lot of noise which can trash your receiver. I used two techniques to prevent this with my keyer/counter. First, as long as you're not hitting a button or keyer paddle, the PIC is asleep with its oscillator turned off and the divider I.C. is held in reset. Second, the receiver is kept muted as long as the processor is awake. Result: no buzzes or carriers anywhere—regardless of what I.F. or operating frequency is in use.

Summary

As of this writing, the schematic and firmware for the keyer/counter module is still in a state of flux, but I have built and field-tested a prototype. By the time you read this, Wilderness Radio will have them in stock as the "WRA-1"—Wilderness Radio's first QRP accessory kit. (Call Wilderness at 415-494-3806 if you're interested, or write to P.O. Box 734, Los Altos, CA 94023-0734. In addition to a complete kit, Bob will be selling the programmed microcessor by itself. In this case, you'll need to add your own speed pot, switches, and a small number of other parts.)

Now I can turn my attention to the last frontier for the NC40A: an internal automatic antenna tuner....72, Wayne, N6KR

3806, or write to: P.O. Box 734, Los Altos, CA 94023-0734

For Sale: NorCal 40A kit, never opened, $110 Cash. Hollis Button, 1025 W. Parr Ave., Campbell, CA 95008. Phone: 408-378-0436.

A Better Mouse Trap

By Ernie Helton, W8MVN
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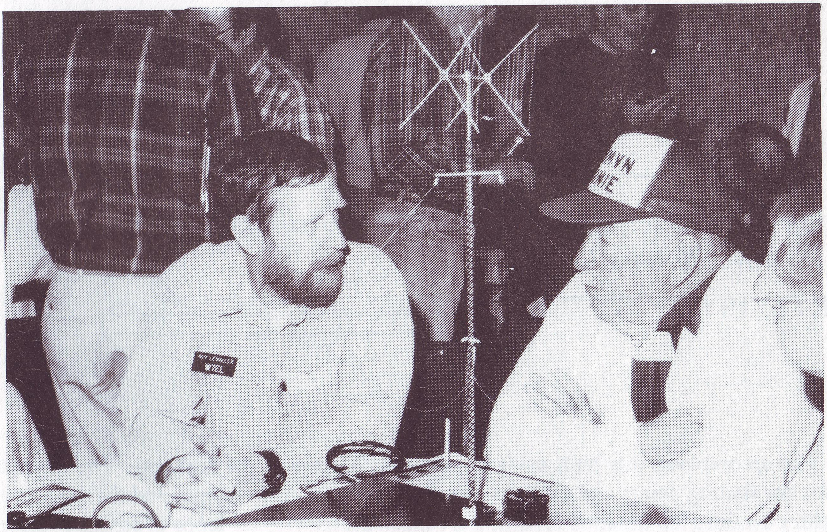
After erecting a 70 foot tower about ten years ago I tried a variety of different types of 40 meter antennas all of which were supported by the tower. Included were dipoles, inverted vees, slopers (both quarter wave and half wave versions), G5RV, bazookas, windoms and extended zepps. Not necessarily in the above order, all of the antennas worked to some extent. No attempt will be made to rate one type vs. another in the following information.

Problems arose using some of the above antennas when they were supported by my tower and its associated guying. My definition of problems include; difficulty resonating the antenna at the desired frequency, unable to get a good impedance match to the feedline, drastic changes in VSWR when the 4 element 20 meter mono bander was rotated, and lots of RF on the rotor control cable at operating position. The worst problems occurred with inverted vees and slopers.



Roy Lewallyn, W6EL with Ernie, W8MVN and his model of his Antenna System

Ok, "What if" I replace the guy wires with a non-metallic material. Phillystran was chosen to replace the metal guys. This resulted in some improvement but apparently the

tower itself was causing most of the problems. The tower alone approximates a 1/2 wavelength vertical at 40 meters. Since most of the antennas mentioned earlier are high Q types and all were adversely affected by the presence of surrounding objects like the tower and its guying. How about a loop???? They are low Q compared to the others. What if I replace the upper guy with a Delta loop configuration? My guying system consisted of four guys at the upper and lower levels and a 12 foot yard arm was used at the upper level to support the wire antennas. A single loop was fabricated and resonated at the desired frequency and matched to the 50 ohm feed line with a quarter wave length of 75 ohm coax. This single loop was used for an extended period with excellent results and none of the problems noted earlier with the other types. It worked so well in fact that I decided to add a second identical loop on the opposite side of the tower to replace the other guy at the upper level. See Figure 1 for details.

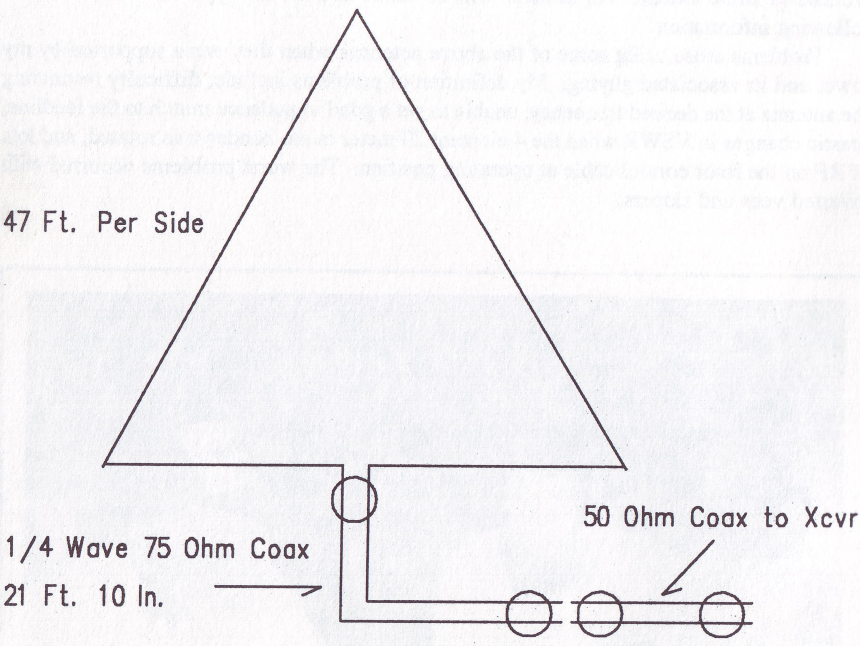


Figure 1

The second loop was built using the same techniques as the first one. The lengths shown are starting points and the loops are to be trimmed to resonance and the 1/4 wave matching sections are trimmed for best impedance match with the loops in position. Now the real fun begins. How do we match the two loops which are 50 ohms impedance to the transceiver? The two loops in parallel now look like 25 ohms to the transceiver. for impedance transformation I used an UN-UN per Dr. Jerry Sevick's book. The details for winding the line transformer are included in Figure 2.

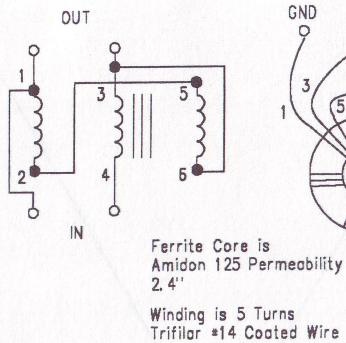


Figure 2

The transformer may be checked for correct connections by using two 50 ohm loads connected to the output side. I tested with a 50 ohm load and a 50 ohm terminated load wattmeter which now indicated approximately 2 watts. Half the 4 watt output from my Ark-40 transceiver was being dissipated in the 50 ohm dummy load and the remaining half or 2 watts was being dissipated in the wattmeters internal load. It is very important at this point that the loops are identical electrically.

This two loop configuration was used for several months and several QRP contests. Some very interesting comments were received from other stations.

"You can't be QRP. Your signal is over S9."

"Your signal was the loudest QRP signal I heard during the entire contest."

It sure would be nice if we could control the directivity of the two loops. Figure 3 shows the two loop configuration used.

This configuration was used about a year and a half with very gratifying results. then the thought arose why not try to control the directivity by feeding one loop and using the other as a reflector similar to a 2 element quad. At this point the two loops were identical electrically with the same resonant frequency and the same feed impedances. What was needed now was a method to lower the resonant frequency of the reflector element. After researching I found I could lower the resonant frequency of the reflector element by adding an open circuit stub of coax.

Most design information for Quad antennas indicate the reflector should be 5% longer than the driven. A stub length of .44 wavelength appears to be about right. Since both of the loops are using the same 1/4 wavelength matching sections of 75 ohm line it was now necessary to trim the 50 ohm feed line to the correct length. I started with a length of 40 feet including the 75 ohm section. The lengths are based on velocity factors of .66 for the coax used.

The next thing was to be able to switch the driven and reflector loops to change directions. **Note: When switching coax feeds, both sides must have the shield on the coax isolated from ground.** Grounds are provided by relay contacts as required. A diagram of the relay switching is shown in Figure 5. The box containing the relays was then placed in the "dog house" already in place on my tower.

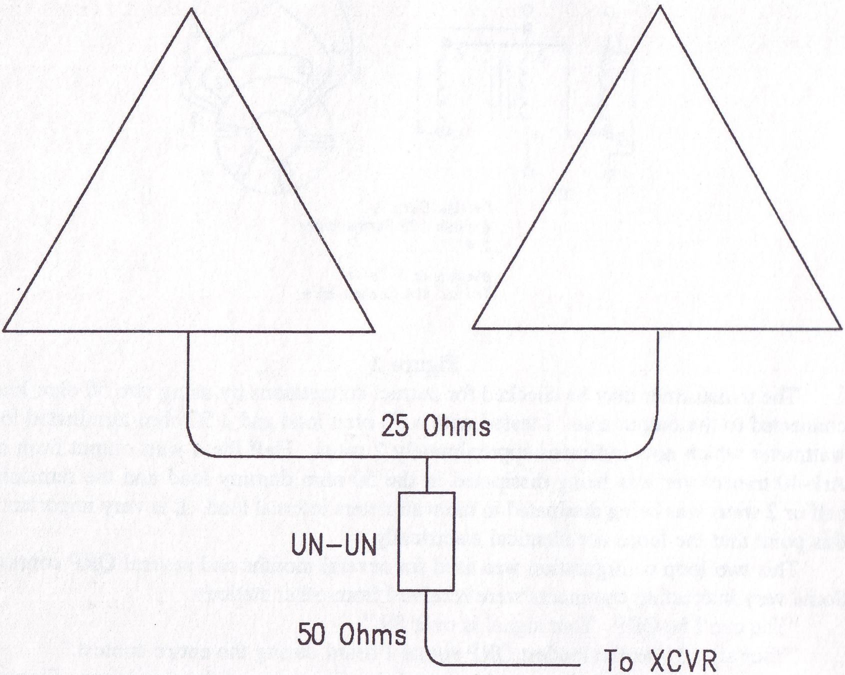


Figure 3

Relay Switching Functions

Antenna Direction	Relay 1	Relay 2	Relay 3	Relay 4
Loop 1 (East) OFF	OFF	OFF	OFF	
Loop 2 (West) ON	ON	OFF	OFF	
Both Driven	ON	ON	ON	

Relays are all DPDT type readily available in most flea markets and DC relays are recommended. Low power types are OK for QRP operation.

Summary:

During the course of many QRP QSO's I have been asked "Exactly what type of antenna are you using there?" I find it is very difficult to describe this antenna system with any degree of clarity. Most of the time I describe it as part of the guying system on my tower and the loops are sloping about 45 degrees. You might even go as far as calling it a two element Delta Beam with a 1/2 wavelength vertical stuck in between (the 70 foot tower being the vertical.)

This antenna system evolved over a period of several years but started with a single delta loop and progressed from there. The purpose of this article is to encourage others to do some experimenting with antennas. No elaborate lab type equipment is required to accomplish the end results. Minimum equipment being a MFJ VSWR analyzer. I

startedwith a Model 250 but have since replaced it with a newer version Model 259 which has proven to be quite adequate for my antenna experimentation.

Your comments and suggestions are welcomed, but a self addressed stamped envelope will be much appreciated. 72, Ernie

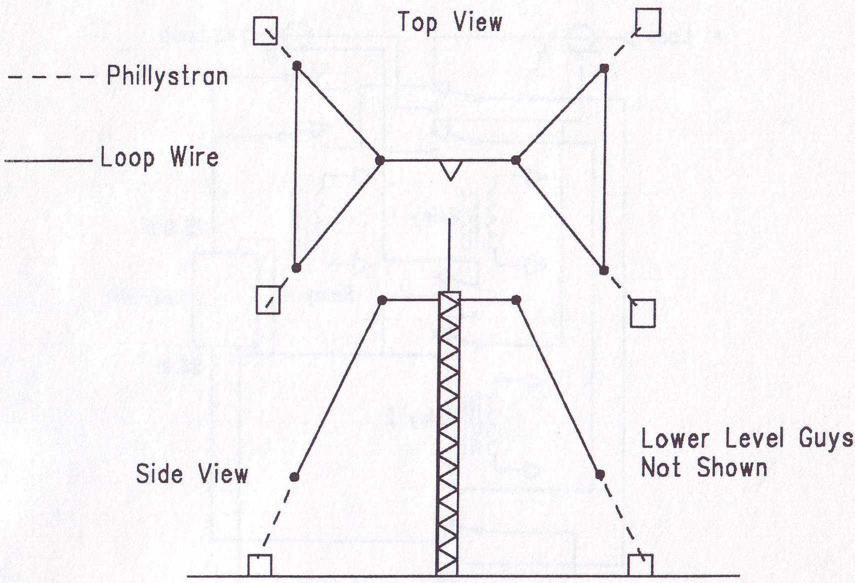
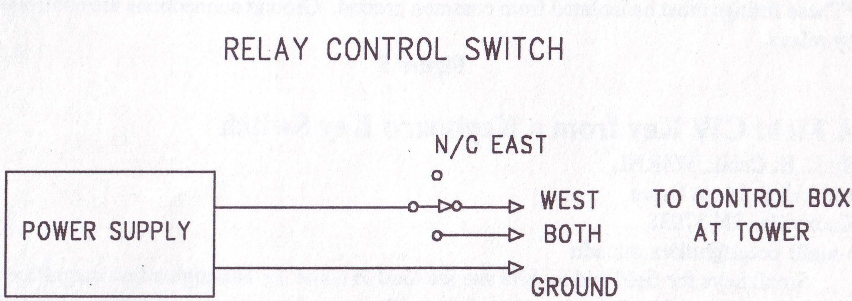
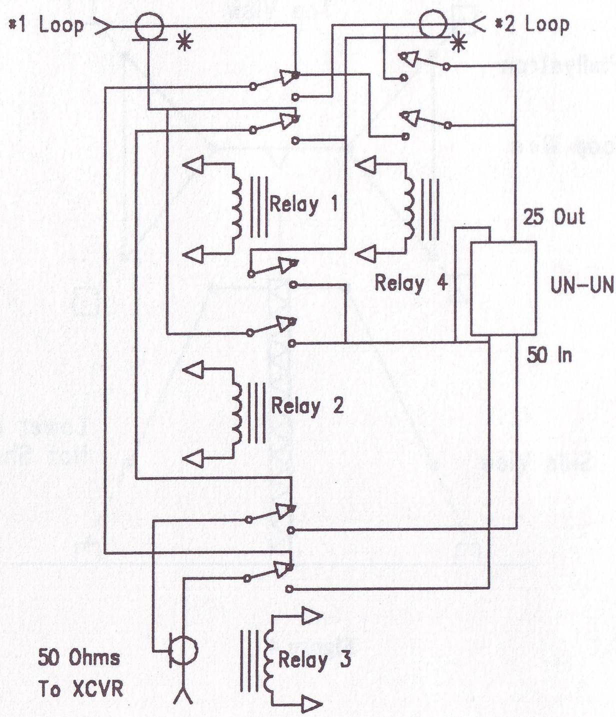


Figure 4





*These fittings must be isolated from common ground. Ground connections are controlled by relays.

Figure 5

A Field CW Key from a Keyboard Key Switch

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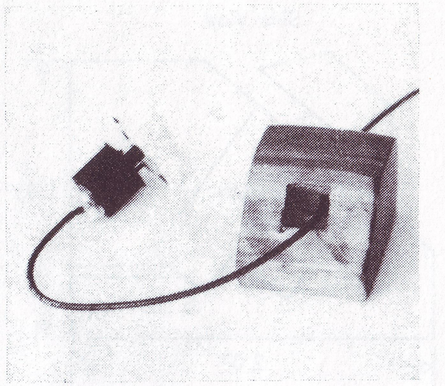
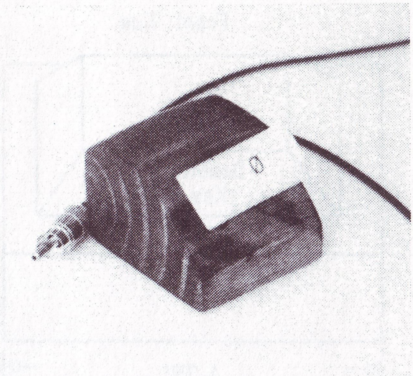
Small keys for field and mobile use are hard to come by, although a few magnificent and expensive works of art do exist, along with some cheap plastic and spring models. However, most QRPers can make a good field key, and probably at no cost. Well, maybe a buck or two for supplies.

A CW straight key is just a switch: technically, a normally-open momentary-contact

single pole single throw switch. The J-38, perhaps the legendary standard of war surplus fame, was made to handle cathode current. Modern rigs use 4-6 volts at well under 1 mA, so the beefy metal work is no longer required. any good switch that fits the fingers that do the sending, that has a reasonable stroke length and return spring, and that can endure manyoperations will do as a CW key. If it happens to be small, so much the better.

Older computer and terminal keyboards, even nonfunctional ones, have 75 to 100 poetential CW keys on every board. The double-wide key caps will satisfy everyone except those committed to Navy knobs. The key switches are durable, but with the right construction, replacing the one in use with a spare is a 30 minute job. I have some 1.25"





long key switches from a very, very old keyboard, but the next generation of key switchees are about 0.75" long with 0.125" long contacts and a case about 0.563" (9/16") on a side. This is perfect for a field key.

The pictures shows the detail of how I encased one in wood. I shaved the 45 degree face in a 2x4 with a table saw, then cut the 4" dimension to 2" and finally took a 1.75" block. The last dimension ensures that the double wide key cap fits within the width of the block.

To make the cut-out for the key switch, I used a drill press to cut the perimeter a wee bit smaller than the case. A Dremel Moto-Tool finished the cut out for a tight press fit of the key switch case. The extra hollow is for the terminals, and the 1/8 inch hole is for the RG-174 cable to the rig. A little sanding, staining, and finishing dresses the key base proudly.

Run the RG-174 through the hole to the cut out. Solder the conductor and shield to the unmounted key switch terminals, and press the case into the cutout wile drawing the cable back out. Do not drill the cable hole too large, since it acts as a strain relief fitting. Glue a pad to the bottom. (I used a piece of textured rubber from a jar cap opener pad.) Then start practicing.

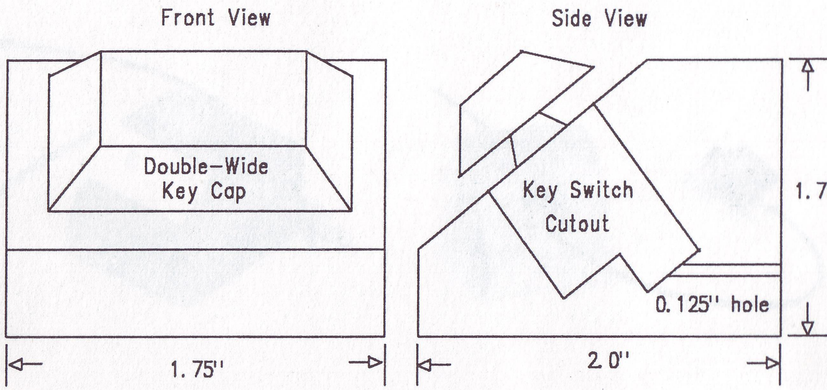
Why the 45 degree face for the key? Two reasons. First, with the key switch vertical, it is too high for easy keying at a desk. In addition, the angled fit, with the contacts oriented up, makes a good fit for accessigble scrap wood.

Second, the 45 degree angle permits keying at almost any angle from 30 to 90 degrees relative to the table top. Many bangers curl (or cramp) their fingers for vertical strokes. The construction of the key switch easily translates this motion into good contact. A more relaxed finger position is closer to the angle presented by the key cap, and with practice, the strain of straight key CW goes away. With the no-slip pad on the bottom, gentle

keying does not make the key walk away.

I anticipate about a year's service from each key switch and have a life time of spares (but no more, since my key switches were left over from a CW keyboard project several years ago.) A full keyboard might serve a club for a decade, even throwing out the unreliable ones. The wood block should last forever. The limiting factor is finding the double wide keycap with a center mounting slot. Soume double wides only have offset mounting slots. "Zero" from the numeric keypad is a good choice and mystifies casual onlookers.

This little key is open to unlimited variations of building style to suit the skills and operating styles of the maker. It is the best "no cost" key I have found.



Some Ideas For an All Band Rig

By Raymond Megirian, K4DHC
606 SE 6th Ave.
Deerfield Beach, FL 33441

During the past dozen years I have done a lot of experimenting with circuitry for an all-band CW/SSB QRP transceiver and have come up with several working models. Mostly they became victims of a relentless desire to see if things couldn't be improved or simplified and were torn apart. The latest one, however, was put on the air by a good friend (I'm a builder not an operator) and has provided excellent results. The rig uses a synthesizer to generate all the LO frequencies and also has a built-in frequency readout. A very compact version of the huff and puff drift correcting circuit was also designed for the VFO and will be described along with the other two sections.

Keep in mind a few of the design features incorporated in the all-band rig. A 2-pole, 12 position rotary switch does all the band switching. One section supplies 12 volts to all switched circuitry except the synthesizer and circuits requiring a regulated voltage. Regulated 10 volts is supplied to these sections via the second switch wafer. The IF is 9MHz and the VFO tunes from 5.5 to 5.0 MHz.

Synthesizer

A Motorola MC145106 PLL IC is used to synthesize all the LO injection frequencies for 12 bands. These include 160, 80, 40, 30, 20, 17, 15 and 12 meters as well as 4 500-kHz segments for 28 to 30 MHz. A 10.240 MHz crystal and on-chip oscillator generate

Ray Magerian's All Band CW/SSB Transceiver

the reference frequency of 10 kHz. Four VCOs are used to cover the required spectrum of 16 to 44 MHz. Diodes are used to program the internal divide by N counter and are supplied with regulated 10 volts from the bandswitch. The output from the VCOs is fed to a broadband amplifier and then to a divide by 10 prescaler to bring the frequency within range of the PLL input. The signal from the amplifier is also fed to one input of a double balanced mixer. The other mixer input is fed from the VFO. The difference frequency is filtered out, amplified, and becomes the LO signal. Table I shows all relationships of these frequencyies and Table II shows the divide by N program.

The post mixer filter is a tuneable affair made up of RF chokes and tuning diodes. It will cover the entire range of 10.5 to 39.0 MHz. Twelve trim resistors mounted on one of the 2 PC boards are each preset to one band and selected by the band switch. The amplifier following the filter is gain controlled so as to provide as constant an output level as possible. The MC145106 provides an out-of-lock signal which is applied to one half of a dual comparator whose output lights a front panel LED to indicate system lock. The other half of the comparator provides an output to inhibit the transmitter in the rig if lock is lost. The 10-volt regulator IC is of the low dropout variety so as to maintain regulationwhen the supply falls below 12 volts. The output from this supply is used not only internally but is brought out to supply one section of the bandswitch and other portions of the rig not shown here.

As mentioned above, the sythesizer is assembled on 2 PC boards. Both boards measure 2 x 4 inches and are stacked sandwich fashion in order to make a compact package. The resulting assembly was housed in a box made from double-sided PC material with outside dimensions of 4-1/4 x 2-3/4 x 1-5/16 inches. All of the interconnections are brought to pads that line up one above the other, making the sandwich more appetizing. Snappable type header material was used for the connections between boards. Male type on one board and female on the other makes it possible to separate the boards if necessary. All electrical connections to the outside are by means of feethru capacitors. RCA phono jacks are used for RF inputs and outputs.

The boards were made using double-sided copper clad material. One side is used as a grond plane and is unetched. Parts are mounted on this side and any part with a lead going to ground has that lead soldered right to the copper surface. Obviously, copper around the through holes must be relieved to prevent shorts. Those holes not to be relieved are marked with an (*). Most of the diodes, chokes and resistors are mounted hairpin fashion but where the span is sufficient a component can lie flat. Before mounting

the MC145106, bend pin 5 straight up and cut off pin 6. Pin 5 becomes a test point and pin 6 is not used. There are no holes in the board for these pins. The 10.240 MHz crystal is a tiny cylindrical type which is mounted with its leads sufficiently long so as to allow the crystal to lie flat on top of the IC. I used a small piece of 2-sided tape to hold it in place. The 10 volt regulator is mounted flat on the ground plane with a screw and nut.

On the bottom board, pins 1,4 and 8 of U1 must be bent to lie flush on the ground plane since no holes are provided. The same goes for the grounded pins of D5, D6, D7 and D8. The tank coils for the VCOs are wound as follows: L1 has 26 turns tapped at 5 turns on a T30-2 toroid. L2 has 20 turns tapped at 4 turns on a T25-6 toroid. L4 has 13 turns tapped at 3 turns on a T25-6 toroid. All coils are wound with #30 wire. Taps are from ground end. Tuning diodes D1-D4 are Motorola MV1662 whcih come as a matched set of 3 but not all sets match each other. A sufficient number should be on hand so that a set of 4 matched diodes can be installed in the filter. Diodes having the same 3-color stripes on their backs would be matched units. Sources will be discussed later.

A high frequency scope and a counter are used to set up the synthesizer. The VCOs have to be adjusted for correct frequency range before the moards are mated. Temporarily tack a piece of wire to the common output line of the VCOs for connection of the scope and counter. Do the same for the common line feeding the tuning diodes so a variable supply of 0-9.5 volts can be applied. Since each VCO covers more than 1 band, 12 volts can be applied to any one of the inputs for a particular VCO and the output frequency checked for the required range. The schematic shows what bands each VCO covers and the frequencies determined from Table I. VCO #3, which is used for 20 and 17 meters, would have to cover from 28.5 to 32.6 MHz. Adjust for the proper range by squeezing or spreading the turns on the coil and when set properly, apply enough Q dope to hold the turns in place as well as to glue the coil to the board. When all VCOs are operating within their specified limits with the tuning voltage of 0-9.5 volts, remove the temporary test leads.

Before mating the 2 boards, solder leads to all the pads going to external connections, making them slightly longer than needed. The board containing the PLL is mounted on top. When assembly is complete, connect a 12 volt supply and VFO to the appropriate inputs. The VFO level should be around 1V P-P. Connect the cathode end of a LED to the LOCK feedthru and the anode to the 12 Volt supply. Apply power and if no smoke is observed, commence set up.

Connect a counter to the pin 5 test point on the PLL and adjust the trimmer capacitor for a frequency of 5.120 MHz. (The 10.240 MHz frequency has been divided by 2 at this point.) Next, connect a high frequency scope and the counter to the LO output and a clip lead from the 160 meter feedthru to the regulated 10V feedthru. It may be a little tricky but a small thin screwdriver can be used to adjust the associated trim resistor for an output of 10.5-11.0 MHz as the VFO is tuned through its range. The counter will verify that you are tuned to the desired mixer product and the scope display will allow adjustment of the filter for a clean signal throughout the segment. This procedure is repeated for each of the remaining bands. While operating on any band, adjust R4 till the LOCK LED just comes on and then a few degrees more. Check all bands to make sure the LED is working and extinguishes when no band is enabled. When the LOCK LED is off, the TRANSMIT INHIBIT output should go high.

The LO output is apporximately 1V P-P and sufficient to drive a DBM such as the SBL-1. The LO is capacitor coupled to the output jack. The second LO output is used for the digital readout and is not DC isolated since a coupling capacitor is located in the readout assembly. If the readout is not to be used, associatd parts may be omitted.

To prevent the bottom board form shorting out against the bottom of the box, a piece of insulating material was placed between board and box. Cut 4 pieces of heavy bus wire

to a length about 1/2 inch longer than the space between boards. Feed each of these pieces through the 4 corner holes till they are flush with the bottom and flow solder around the wire and ground plane of each board. The extra half inch can be bent to rest against the inside of the box and soldered in place. This provides a common ground for everything as well as holding the assembly in place.

Frequency Readout

The heart of the frequency readout is the Sub-Cub 1 by Red Lion Controls. This little device contains all of the counting circuitry and 6 digit LCD in a package approximately 1-1/16 x 11/16 x 7/16 inches. The unit is fastened to a small PC board by its own ramp-lock pins and fed by cable from the remaining circuitry which is housed in another small box made from PC material.

The LO signal from the synthesizer connects to one input of a NE602 mixer while the other input is from the carrier oscillator (BFO). When mixed, these signals produce a difference frequency equal to the operating frequency. This signal passes through a filter to separate it from the other mixer products and then is divided by 100 in order to come within frequency range of the Sub-Cub counter which will operate up to 500 kHz. The standard 1-second time base is generated by a 3.58 color burst crystal and MM5369EST IC. This produces a 100 Hz output which is divided by 100 in a RDD104 IC to end up as the 1-second clock. A CD4528 dual monostable oscillator generates the latch and reset pulses for the Sub-Cub 1.

A tuneable filter similar to the one used in the synthesizer is employed here to extract the operating frequency from the mixer. However, this filter will not cover the entire range from 1.8 to 30 MHz so it was used in conjunction with a fixed bandpass filter for 160 and 80 meters. The tuneable filter covers the remaining bands of 40 through 10 meters.

The original rig contained a small board which acted as a main junction point for all the bandswitching cables as well as a few miscellaneous components which included the preset trim resistors for the readout filter. Since these were not mounted on the main board and since the layout was not compatible with standard size components, no PC artwork is shown. The main object was to introduce the Sub-Cub 1 to those not familiar with it and suggest the possibilities of including it in a readout for your rig.

With a 1-second time base there will obviously be a lag in the frequency being displayed as the rig is tuned across the band. I used a supplemental dial for ordinary tuning and the counter to indicate the exact frequency when parked. If desired, a switch can be incorporated to connect pin 1 of the RDD104 to the 6-volt supply in which case the time base becomes .1 second and allows the counter to follow more rapidly. This will result in the loss of 1 digit, however, and resolution becomes the nearest 1 kHz rather than the nearest 100 Hz. The switch can be a push button used only to achieve fast count when desired and allow return to normal when released. The schematic shows this option.

As shown on the schematic, both bandswitch sections are used to control the readout. The regulated 10 Volt section is used to supply the trim resistors which tune the filter for 40 to 10 meters. The 12 Volt section is used to enable the particular filter in use. Connect a scope to the test point noted on the schematic and with the rig tuned to either 160 or 80 meters, adjust the 200K trimmer for a square wave output. The frequency reading should be correct for the band in use. Check both 160 and 80 meters for proper readings throughout the entire range. The remaining bands are individually tuned by their associated trim resistors. The 10 meter band requires only a single trimmer but make sure the counter works properly across the entire range of 29 to 30 MHz. The filter will tune to various mixer products which produce falsecounter readings so adjust the pots slowly till the Sub-Cub reads what you are looking for. Fine adjustment of the 200K threshold pot may also

help; especially on 10 meters where a very wide band is being covered.

The small single-sided PC board required for mounting the Sub-Cub 1 is shown along with the artwork for the other boards. The elastomeric conductors on the back of the device compress against the pads on the board which should be clean and smooth. The data sheet suggests gold or tin-lead plating. I used Cool-Amp silver plating powder on mine. The 2.4M, 1/8 watt resistor should be mounted on the back of the board so as to not interfere with the Sub-Cub 1. The 2 outermost holes are for mounting the board to the front panel. I made a rectangular hole in the front panel just large enough to view the display and allow the remaining frontal area of the Sub Cub to butt against the back of the panel. A pair of long 2-56 screws were then passed trough the front panel and the 2 mounting holes in the board to snug up the assembly and hold it in place. The inner holes accept the lock-ramp pins on the back of the Sub Cub 1 and are to be .120" in diameter. The polarizing pin goes in the hole above the left mounting hole and is .093" in diameter. The 4 leads feeding the display were fed though a piece of shield salvaged from scrap coax. The shield was grounded where it exited the readout box and connected at the other end to the ground return pad on the Sub-Cub board.

Drift Corrector

I have been using this marvelous device since the '70s and feel that PA0KSB should be awarded a medal for his achievement. There have been many follow-ups over the years to Klaus Spaargaren's gem and the only reason I included it here is to present a very compact version of the circuit using standard components. Size reduction for this unit was achieved through the elimination of one 16-pin IC and substitution of an 8-pin IC for a 16-pin one. The customary crystal was also changed to a tiny 100 kHz unit which made all the above changes possible. This brought the size of the board down to 1-1/2 x 1/1/2 inches.

I'll not go through any theory here but if you are interested you can refer to articles in Ham Radio for December 1977 (PA0KSB), June 1979 and August 1987. There have been others but these should suffice.

Some indication as to the status of the DC control voltage being applied to the tuning diode is necessary in order to keep the voltage within operating limits or control will be lost. PA0KSB used a small meter across the control line to monitor the DC level and I favor this method myself. Some of the articles mentioned above used LEDs to indicate when the voltage was near maximum or minimum but the added circuitry and IC's would have defeated my desire to keep it small. The meter used is one of the once popular 1/2" round status indicators used on battery operated devices. There are some of these still around and can be found at hamfest flea markets. A 500 uA movement is common and quite suitable. A series resistor is selected to allow full scale deflection with maximum control voltage. The UP and DOWN push buttons are used to bring the control voltage within operating limits and also useful for fine tuning the VFO when the other station drifts. My VFO stays on frequency for hours right from turn on.

A double sided board was used here too, with the unetched side used as a ground plane. Here again the copper around through holes must be relieved.

The most troublesome component used in the device is the 100 meg resistor required for the long time constant. Generally a bunc of resistors in series is the accepted means of satisfying this requirement but I have shown only 2 holes in the PC board. At one time I actually ahad some 100 meg, 1/8 watt resistors given to me by my friend NI4Q (who now has the rig) so I know they actually made such things. However, I have never seen or heard of any others and don't know where he got those many years ago. Instead, I make my own form carbon composition types. I have a bunch of 1/8 watt, 22 meg resistors that have been in a drawer for years and now have a noble purpose in life. By heating these wtih a

soldering iron I can get them to assume much higher values of resistance. I built a megohmmeter to monitor the resistor while heating it so that I could zero in on 100 megs. Several applications of the iron are necessary to get the part to settle at 100 megs as it cools. One can also go too far and end up beyond 100 megs so spares are needed. After a couple of weeks I check them again to make sure they are fixed at somewhere between 90 and 100 megs.

If you are planning to build this item you can bundle a series string of 1/8 watt resistors and insert the start lead in one hole and the tail lead in the other hole or re-do the artwork with more holes and make a new board. Also, as long as my supply lasts, I will send you a manufactured resistor for a SASE.

Almost any varactor diode of small capacitance can be used to control the VFO. I used a 4000 series glass rectifier diode with good results. The amount of coupling capacity to the VFO tank coil will vary with design of the circuit but generally will be only a few pFs. Check the total frequency excursion around mid-band by using the UP/DOWN push buttons. About 3 kHz is desirable and if necessary, the value of coupling to the tak coil can be adjusted.

Before installing U1, bend pins 1, 2, 3, and 4 to be flush with the ground plane. Do the same with pins 4, 6, 7 and 8 of U2 and also cut off pins 2 and 12. U3 has pins 4, 6, 7, 9, 11 and 13 cut off and pin 10 grounded. Cut off pins 1, 5, and 8 of U4 and ground pin 4. The 20 meg resistor across pins 5 and 6 of U1 was made up of 2 10 meg units since at the time I had no 20 meg resistors and was not manufacturing custom parts.

Concluding Comments

When I first asked Doug Hendricks about the suitability of doing this article, he thought I should cover the entire rig. This would have been much too cumbersome for the limited interest it might create and would not have been easily duplicated. Instead, I chose to present a few ideas that worked well for me and could perhaps give other readers ideas to put to use in their own designs.

Digikey Corporation was the source for some of the parts used in these projects:

Low profile TV crystal	X079-ND	$1.56
10.240 MHz crystal	SE3421-ND	$1.29
100 kHz crystal	SE3333-ND	$1.44
6 mm trim resistors	Various	$0.51
1.0 uF film cap[	P4675-ND	$0.75
Sub-Cub 1	RLC1000-ND	$18.00

The matched sets of 3 tuning diodes are available from: Marlin P. Jones & Assoc., Inc. P.O> Box 12685, Lake Park, FL 33403 for $1 per set. Same price also from: Hosfelt Electronics, Inc., 2700 Sunset Blvd., Steubenville, OH 43952.

The BB104 dual tuning diodes were purchased from: Fertik's Electronics, 5400 Ella Street, Philadelphia, PA 19120. Price and availability at this time unknown. The electrolytic capacitors were tantalum while the coupling and bypass capacitors were mostly monlythic types. Resistors were 1/8 watt carbon film and as many parts as possible were of the miniature variety.

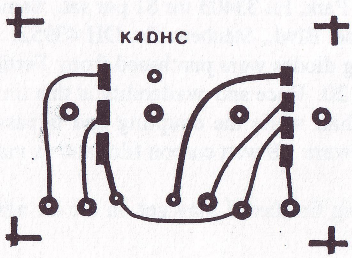
If I ever get the next rig finished, I may get on the air again after over 40 years of inactivity. 72, Ray, K4DHC

TABLE I

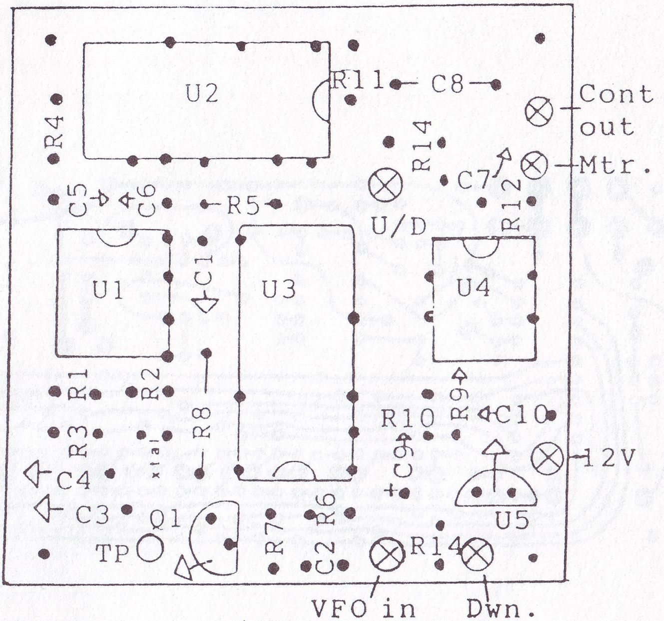
Band	Syn. Out (MHz)	LO Injection (MHz)	Band Coverage
160	16.0	10.5-11.0	1.5-2.0
80	18.0	12.5-13.0	3.5-4.0
40	21.5	16.0-16.5	7.0-7.5
30	24.5	19.0-19.5	10.0-10.5
20	28.5	23.0-23.5	14.0-14.5
17	32.5	27.0-27.5	18.0-18.5
15	35.5	30.0-30.5	21.0-21.5
12	39.0	33.5-34.0	24.5-25.0
10	42.5	37.0-37.5	28.0-28.5
10	43.0	37.5-38.0	28.5-29.0
10	43.5	38.0-38.5	29.0-29.5
10	44.0	38.5-39.0	29.5-30.0

TABLE II

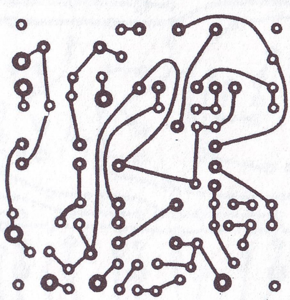
Syn. Out (MHz)	Div. by	Program Powers of 2
16.0	160	7+5
18.0	180	7+5+4+2
21.5	215	7+6+4+2+1+0
24.5	245	7+6+5+4+2+0
28.5	285	8+4+3+2+0
32.5	325	8+6+2+0
35.5	355	8+6+5+1+0
39.0	390	8+7+2+1
42.5	425	8+7+5+3+0
43.0	430	8+7+5+3+2+1
43.5	435	8+7+5+4+1+0
44.0	440	8+7+5+4+3



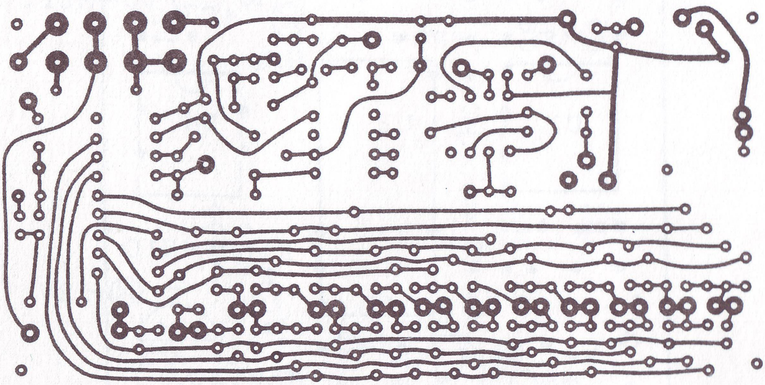
Sub Cub Mount (Copper Side)



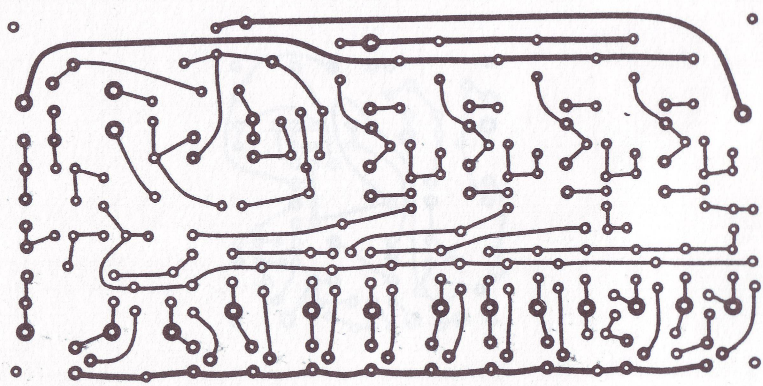
Drift Corrector Parts Placement



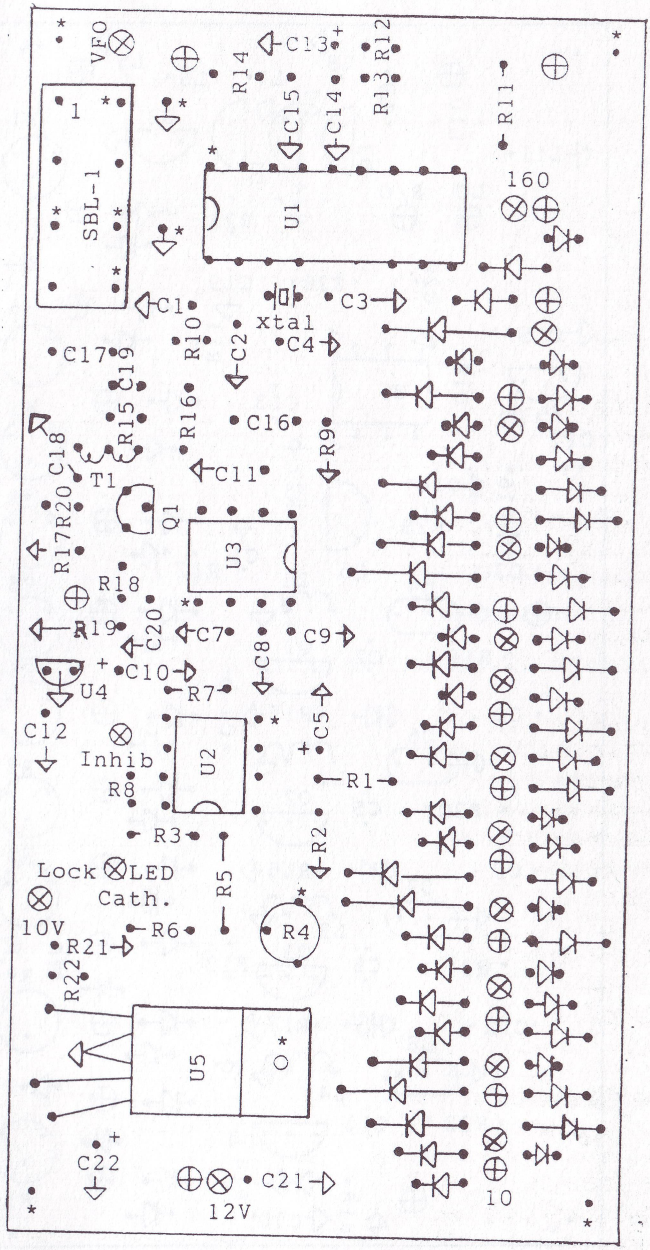
Drift Corrector (Copper side)



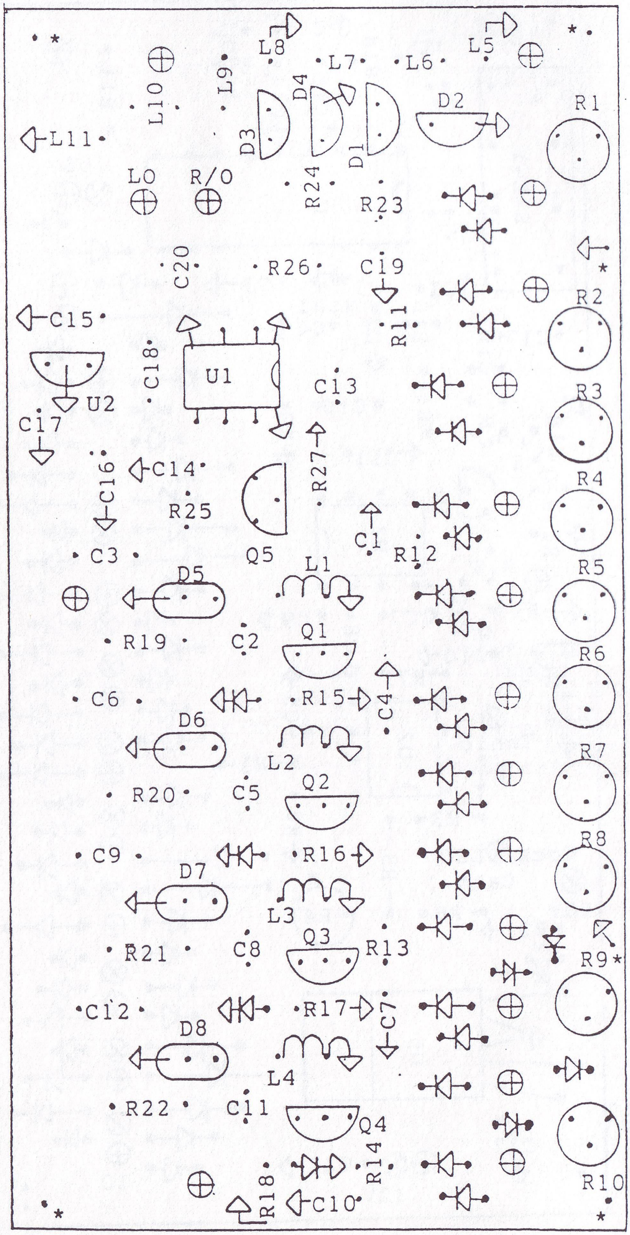
Synthesizer Top (Copper Side)



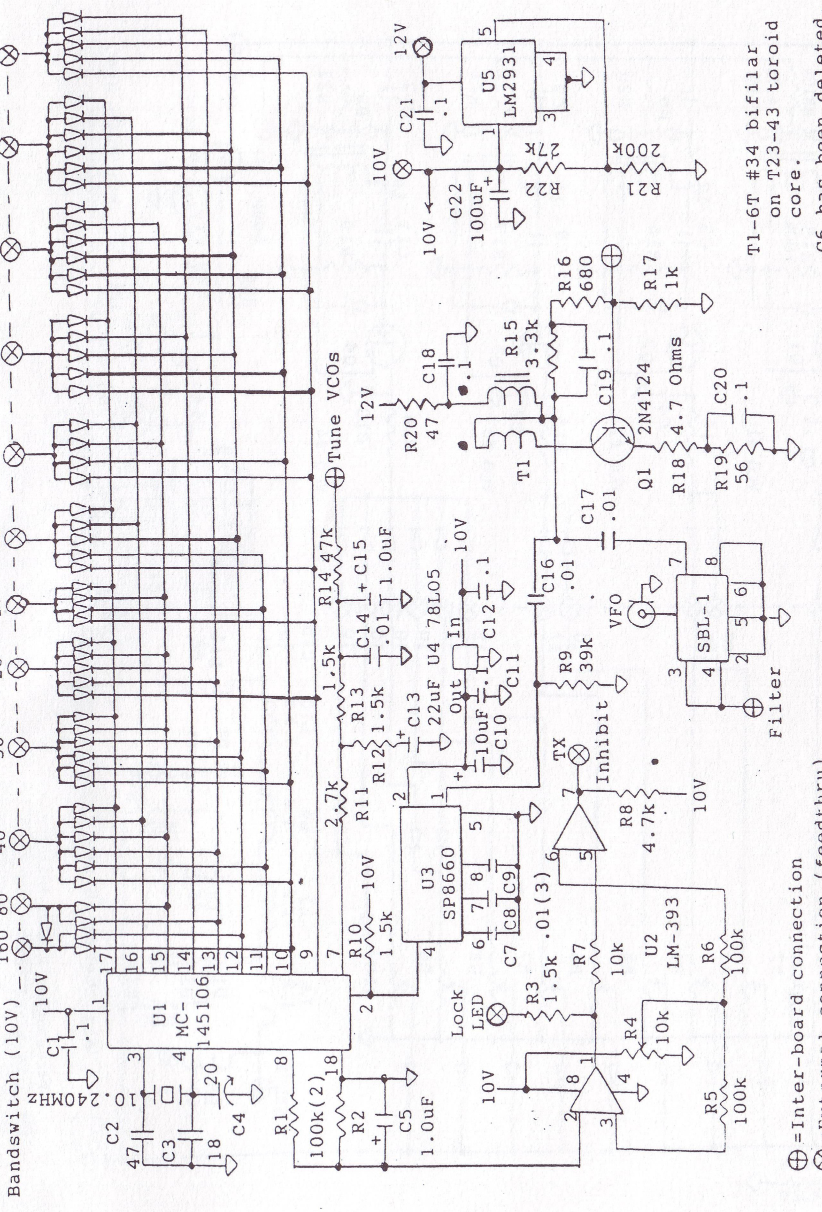
Synthesizer Bottom (Copper Side)



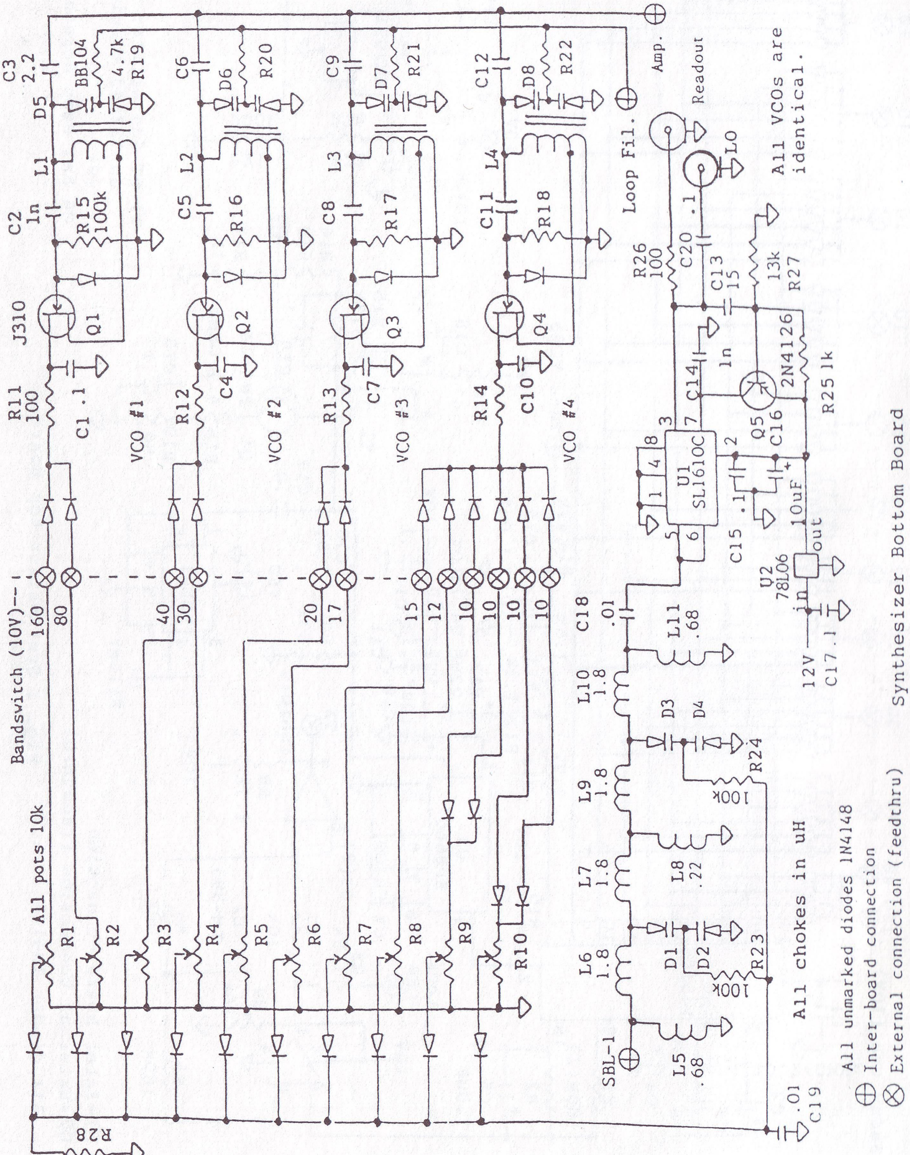
Synthesizer Top Parts Placement



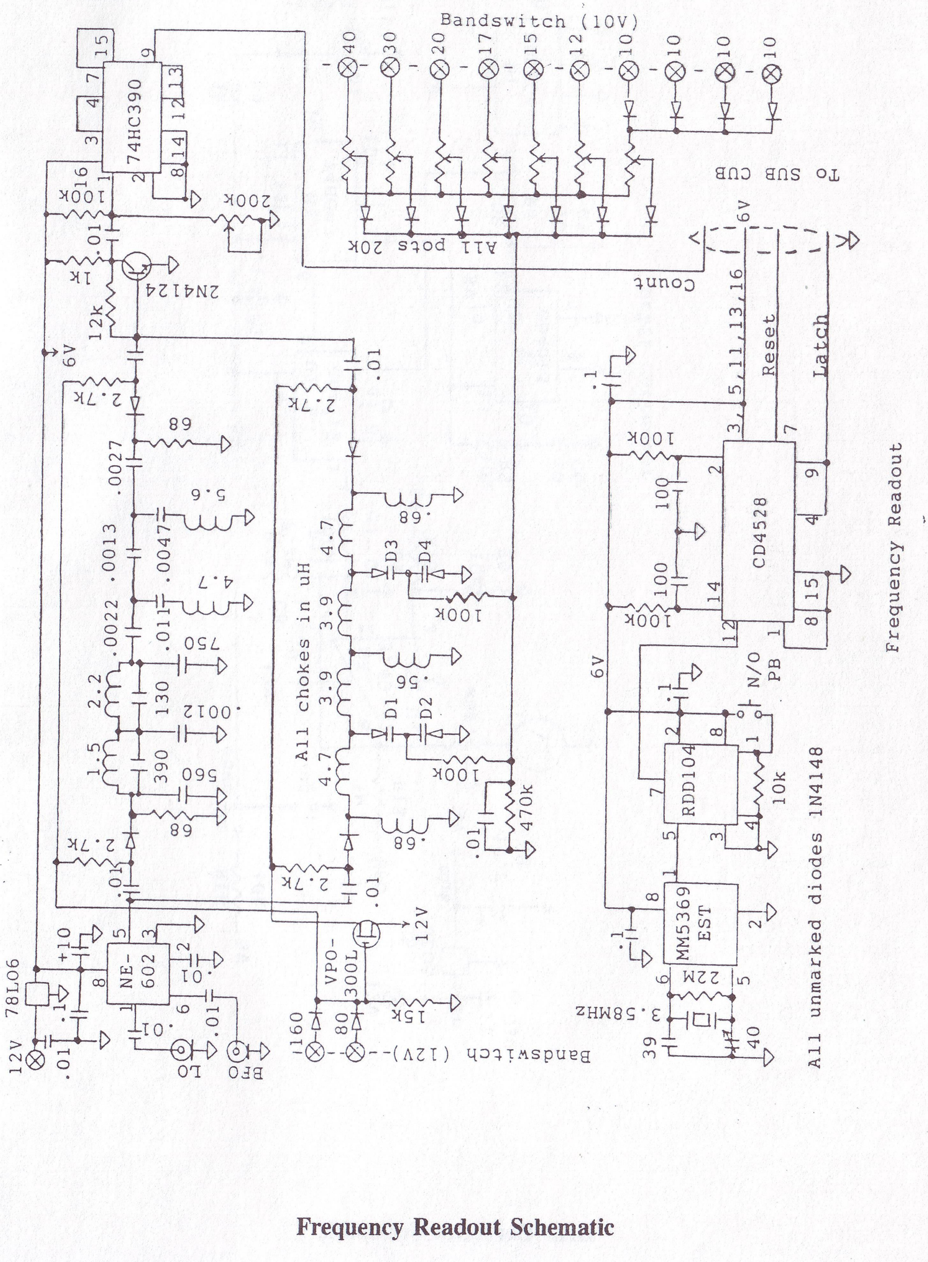
Sythesizer Bottom Parts Placement



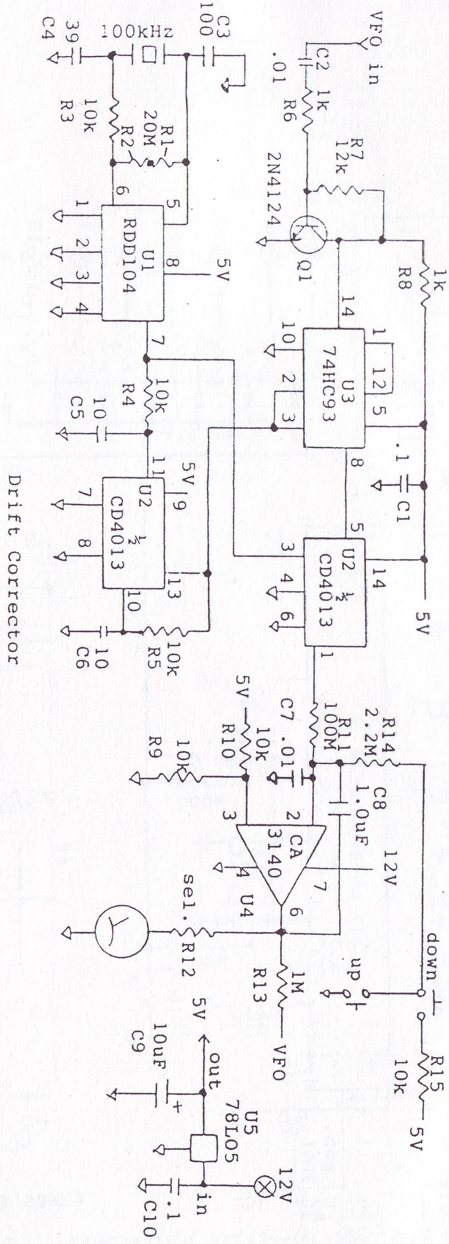
Synthesizer Top Board Schematic



Synthesizer Bottom Board Schematic



Frequency Readout Schematic



Drift Corrector Schematic

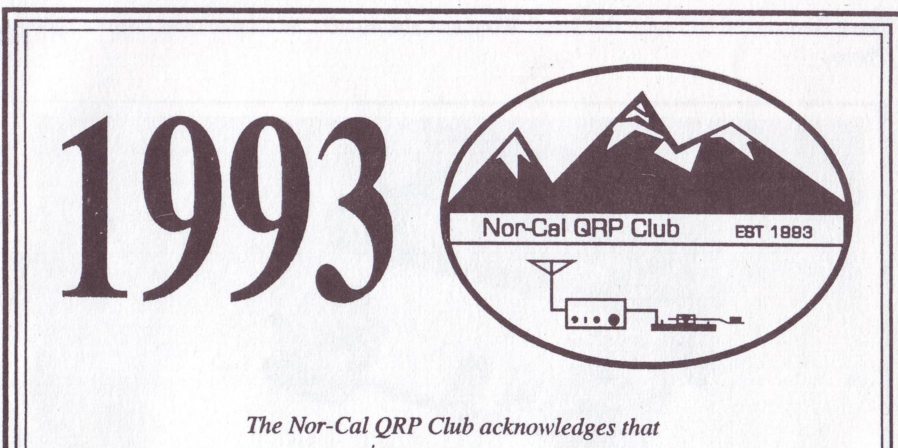
NorCal Membership Certificates Available

by Bob Finch, N6CXB
7530 Ridgeview Lane
Lafayette, IN 47905

I have available NorCal Membership Certificates that are laser printed and available for $2.50 postage paid. The certificates are printed on high quality paper in 2 colors, with your name, call, membership number and year of membership in red. The club logo and the rest of the lettering is in black. If you would like a certificate, please send your name and membership number to me at the address above along with a check or money order made out to Bob Finch for $2.50 and we will ship you your personalized membership certificate to NorCal in 3 to 4 weeks. The size of the certificate is 8.5" x 11", but it may be cut down to fit in an 8" x 10" frame. **DO NOT MAKE CHECKS OUT TO NORCAL!**

The certificates were designed by Jeff Stewart, KF9UP, and are provided as a service to NorCal by Jeff and myself. They are shipped flat in a 9 x 12 manilla envelope to avoid folds.

NOTE: Bob and Jeff offered to do this service for the club. I have seen the the certificates and they are absolutely beautiful. We did not want to raise the cost of joining the club ($0.00), so we decided that those members who wanted a membership certificate would pay for them, and those that did not, would not have to pay for something that they did not want. Thanks to Bob and Jeff for providing this service. A copy of the certificate is below.


1993

Nor-Cal QRP Club EST 1993

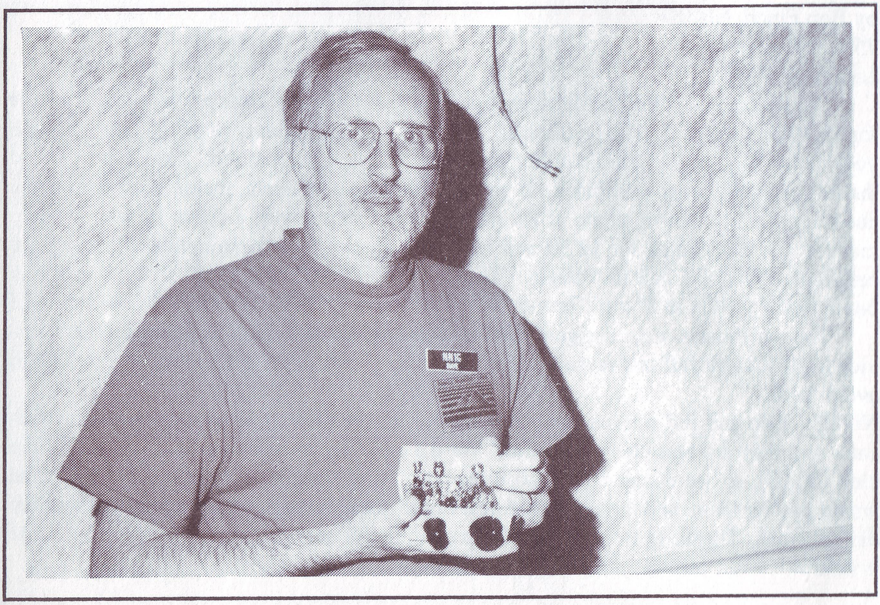
The Nor-Cal QRP Club acknowledges that

Douglas E. Hendricks - KI6DS

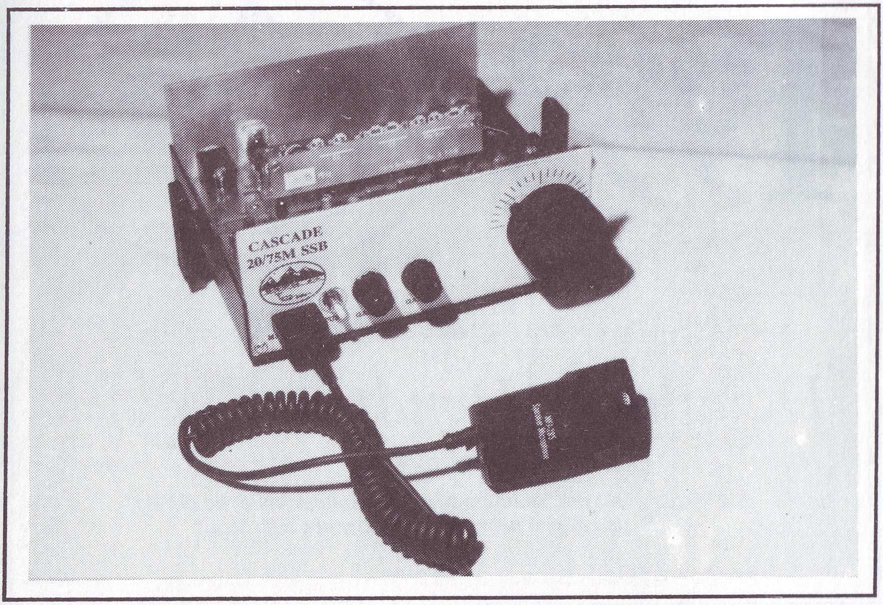
NorCal #2

is a Member in good standing who has demonstrated the ability, skills, and desire necessary to "do more with less."

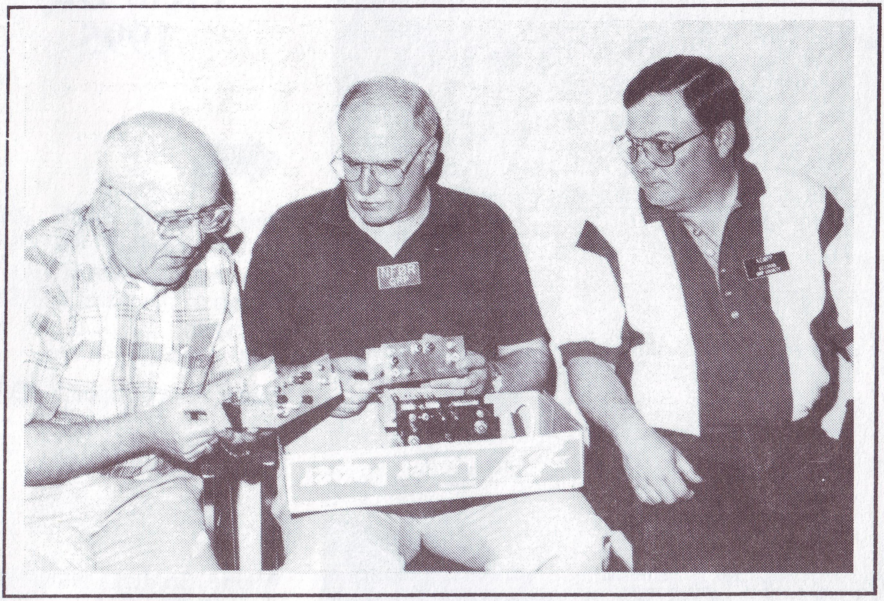
NorCal Membership Certificate



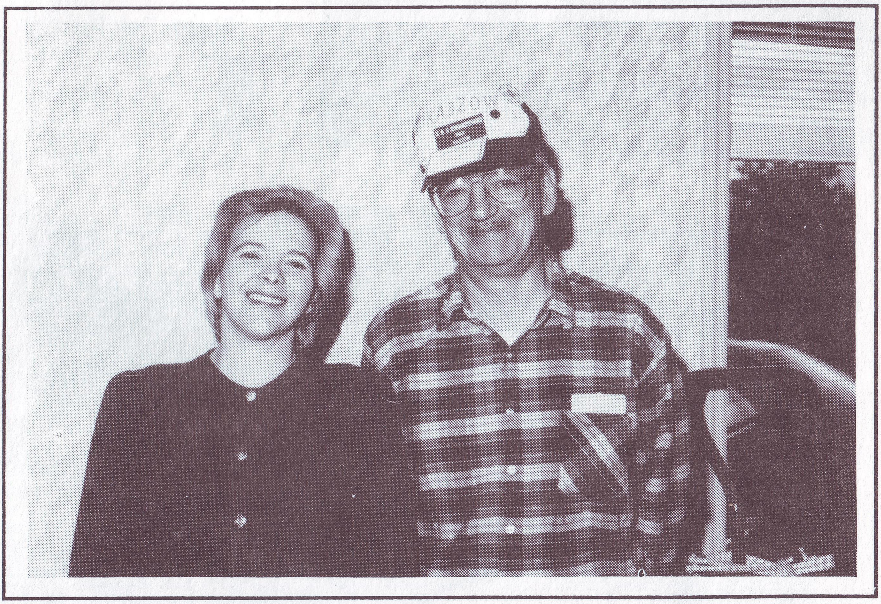
Dave Benson, NN1G with the Small Wonder Labs 40-40 CW Transceiver. Steve Hideg Photo.



The Cascade, NorCal's SSB Transceiver Kit, on display at Dayton. Steve Hideg Photo.



Doug Hendricks, KI6DS, Dave Gaulding, NF0R, and Keith Arns, KC0PP looking over the prototypes of the St. Louis Tuner. Steve Hideg Photo.



Cathy and Dick Sysmanzki, KA3ZOW from S & S Engineering. Dick is the designer of the ARK 40 & ARK 80 CW transceivers. Steve Hideg Photo.

Field Day 1995

Field Day at Eagle Rock with the **NorCal QRP Club.** Eric Swartz, WA6HHQ at the top of the tower and Stan Goldstein, N6ULU at the base.

Photo: Stan Cooper, K4DRD

Wayne Burdick, N6KR and Cam Hartford, N6GA, at the 20 meter operating position for the **Zuni Loopers** at Field Day 1995.

Photo: Bob Heusser

Back Issues of QRPp

Back issues of QRPp are available in bound issues only. Volume I contains the 3 issues from 1993, and Volume II contains the 4 issues form 1994. Volume I is 140 pages and costs $10, while Volume II is 296 pages and costs $15. Both years are $25. To order, send your money to: Doug Hendricks, KI6DS, 862 Frank Ave., Dos Palos, CA 93620. Make all checks and money orders out to Doug Hendricks, and NOT to NorCal! DX orders please include $10 extra per order for postage. All prices are for US Funds only!

Curtis 8044ABMKeyer Chip and Far Circuits Board Combo

NorCal has made a bulk purchase of the Curtis 8044ABM Keyer Chip and is offering it with the Far Circuits Board and the Info Sheet for $17.00 Postpaid. DX orders add $5 shipping. US Funds ONLY!! Make Checks or Money Orders out to Jim Cates, NOT NorCal! Send your orders to: Jim Cates, WA6GER, 3241 Eastwood Rd., Sacramento, CA 95821.

7.040 Crystals

We have located a supply of 7.040 crystals in the small HC49 holders. These are on the QRP calling frequency for 40 meter CW. The price is $3 each, or 4 for $10, postage paid. Make Checks or money orders out to Doug Hendricks, NOT NorCal. Send to: Doug Hendricks, 862 Frank Ave., Dos Palos, CA 93620.

NorCal QRP Club

QRPp is published at Dos Palos, California 4 times per year: March, June, September, and December. Subscription fee is $10 per year for US residents, $15 per year for Canada, and $20 per year for DX. To join NorCal QRP Club send your name, call, and address to Jim Cates. There is no charge for membership to NorCal QRP Club. To receive QRPp, you must subscribe and pay the fees. Send your money (US Funds ONLY) to:

Jim Cates, WA6GER
3241 Eastwood Rd.
Sacramento, CA 95821

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